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Unmanned Aerial System (UAS) platforms have the potential to serve as effective force multipliers in the maritime environment by augmenting Coast Guard aviation in maritime intelligence, surveillance, and reconnaissance (ISR), and enhancing maritime domain awareness (MDA). However, the UAS program has been plagued with numerous technological and funding uncertainties. As a result, the Coast Guard has been unable to develop an operational UAS program. This study uses analysis techniques such as literature search, interviews, and the author's personal knowledge – all becoming input to a strategic formulation methodology and risk assessment. This methodology will provide a structured analysis of the Coast Guard's strategic objective, strategic environment, strategic development, and decision points relating to the UAS program. Recommendations include combining the Customs and Border Patrol and Coast Guard Land-Based UAS programs, developing a Department of Homeland Security UAS strategic roadmap, and pursuing small tactical cutter-based UAS platforms as part of the Coast Guard UAS strategy.

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THE UNMANNED INITIATIVE:

A STRATEGIC APPRAISAL OF COAST GUARD UNMANNED AERIAL SYSTEMS

by

John Egan

LCDR, U.S. Coast Guard

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A paper submitted to the Faculty of the Joint Advanced Warfighting School in partial satisfaction of the requirements of a Master of Science Degree in Joint Campaign Planning and Strategy. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Joint Forces Staff College or the Department of Defense.

This paper is entirely my own work except as documented in footnotes. (or appropriate statement per the Academic Integrity Policy)

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ABSTRACT

The Coast Guard recognizes that Unmanned Aerial System (UAS) platforms have the potential to serve as effective force multipliers in the maritime environment by augmenting existing Coast Guard aviation in the generation of maritime intelligence, surveillance, and reconnaissance (ISR), and enhancing maritime domain awareness (MDA). However, the UAS program has been plagued with numerous technological and funding uncertainties. As a result, the Coast Guard has been unable to develop an operational UAS program to leverage enhanced capabilities for the execution of Coast Guard and Department of Homeland Security (DHS) missions.

This study analyzes the Coast Guard's persistent UAS acquisition attempts from 2002 to 2010. The analysis techniques used are a literature search, interviews, and the author's personal knowledge – all becoming input to a strategic formulation methodology and risk assessment. This methodology will provide a structured analysis of the Coast Guard's strategic objective, strategic environment, strategic development, and decision points relating to the UAS program.

The resulting recommendations include combining the Customs and Border Patrol and Coast Guard Land-Based UAS programs, developing a Department of Homeland Security UAS strategic roadmap, and pursuing small tactical cutter-based UAS platforms as part of the Coast Guard UAS strategy.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

In 1942, it was a Coast Guard officer who had a vision for one of the newest advances in aviation. LCDR Frank Erikson saw the unique potential of helicopters to conduct anti-submarine warfare and rescues at sea, even though a helicopter only existed as a prototype. Convinced that the helicopter would define a new generation of flight, Erickson and a small cadre of Coast Guard officers pushed for the adaptation of this new technology with senior Coast Guard and Navy leaders. Although Coast Guard Commandant, Vice Admiral Russell R.Waesche, was initially unreceptive to the idea, Waesche was so impressed after witnessing a helicopter demonstration that he urged the Chief of Naval Operations, Admiral Ernest J. King, to develop the helicopter for naval use.[1]

In 1943, Admiral King ordered the Coast Guard to acquire helicopters for anti-submarine use. King also designated the Coast Guard as the service responsible for helicopter training, research and development. With no established training facility, Erickson was ordered to the Sikorsky Aircraft Company's plant at Bridgeport, CT, to learn to fly and develop techniques for the new helicopters being manufactured there, thus forming the first Coast Guard Helicopter Detachment. Erickson was designated as Coast Guard Helicopter Pilot No. 1 and became an instructor. The helicopter training detachment was later moved to Coast Guard Air Station Brooklyn, New York. This event formally established the air station as a helicopter training base, where Erickson was appointed as commanding officer. Shortly after this, the British Admiralty requested that

[1] Sikorsky Archives, "The Development of the Helicopter" Sikorsky Archives, www.sikorskyarchives.com/tdoth.html (accessed Jan 11, 2011).

the Coast Guard train several of their pilots and mechanics. Erickson supervised the training of hundreds of Coast Guard, Navy, Army Air Corps and Royal Navy aircrews and mechanics. Erickson also spearheaded numerous design improvements and employment concepts - most notably the towed array sonar, helicopter sling and floatation devices, and the hydraulic rescue hoist. Erickson demonstrated the life saving capability of helicopters when he personally participated in the first helicopter rescue while responding to an explosion aboard the USS *Turner* in New York harbor in 1944.[2] Erickson's determination and beliefs ushered in a new age of aviation for the Coast Guard and the world.[3]

Erickson's success provides an important lesson for the future of aviation and military aviation as a whole. While remaining a strong advocate for new technology, he also knew it was essential to carefully navigate the political, financial, and technological minefields that came with the undertaking of building a new program. Today, the Coast Guard employs over 140 helicopters conducting missions ranging from drug interdiction, environmental response, to emergency search and rescue. In the aftermath of Hurricane Katrina, Coast Guard helicopter crews alone accounted for over 12,450 lives saved.[4] Helicopters have become an essential part of the Coast Guard and a very prominent symbol of its capabilities.

Today, Unmanned Aerial Systems (UAS) represent a new technology for the Coast Guard in the same way that the helicopter did in 1942. Just like then, America was at war and a new technology stood ready to be developed and applied to America's

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[2] Sikorsky Archives, "Development of the Helicopter."

[3] Ibid.

[4] Scott Price, "The U.S. Coast Guard and Hurricane Katrina," U.S. Coast Guard, http://www.uscg.mil/history/katrina/karthistory.asp (accessed Mar 9, 2011).

defense needs. UAS platforms represent that technology that will give the Coast Guard the capability to enhance America's security. Unlike 1942, there is no LCDR Erickson to provide the leadership and advocacy necessary to scale the bureaucratic barriers that exist. The Coast Guard is on the cusp of a new age in aviation. How the Coast Guard proceeds with its UAS strategy and overcomes the barriers to success, will define whether or not the service can enhance its capability and in doing so, define the next era in Coast Guard aviation.

Scope

The acquisition and employment of a UAS system will be a critical component for the future modernization and capability of the Coast Guard. Since 2002, the Coast Guard has had a vision to field Unmanned Aerial Systems as a maritime surveillance package essential to supporting and prosecuting multiple Coast Guard missions (see Illustration A). An Unmanned Aerial System includes all components necessary to operate an unmanned aerial vehicle (UAV). This includes the aircraft, ground control stations, supporting equipment, mission payload, remote personnel to operate the UAV and analysts to exploit the payload data. The UAS program is a component of the Coast Guard's broader system-of-systems Deepwater Asset recapitalization program, where the unique capabilities of individual assets are essential to the broader performance criteria of all assets. Deepwater was originally a broader acquisition strategy for UAS platforms. Because of this component relationship, understanding the Deepwater program is critical to understanding the UAS strategy, its evolution, and its influence on the future viability of the UAS program.

However, numerous problems have tainted the Deepwater program, causing the UAS program to be cancelled and restarted over several years. Although the Coast Guard has developed a UAS strategy, this strategy does not take into account technological, bureaucratic, and funding uncertainties. As a result, the Coast Guard has been unable to develop an operational UAS program to leverage enhanced capabilities for the execution of Coast Guard and Department of Homeland Security (DHS) missions. Delays in delivering the UAS capabilities have resulted in major capability gaps in maritime patrolling and surveillance, along with weakened performance of other major Coast Guard team assets. Safety and regulatory roadblocks for UAS operation in the United States National Airspace System have also clouded the future of any operationally viable UAS program. These regulatory issues focus on numerous UAS related safety, reliability, and technology shortfalls. A national effort from numerous agencies and Congress will be needed to overcome these limitations.

In the meantime, the Coast Guard has established partnerships with other government agencies to leverage their UAS experience. Teaming with Customs and Border Patrol (CBP) land-based UAS program, Coast Guard aviators have qualified and flown joint missions, and have developed a joint concept of operations with CBP (see Illustration B). The Coast Guard has crafted a relationship with the Navy to develop and test a cutter-based UAS platform; however this program is not as mature and is years away from employment (Illustration C). While these partnerships are positive steps, the Coast Guard has become dependent on these partnerships for advancing its own UAS program. This is partially due to funding shortfalls which have plagued the UAS program from its inception.

Compounding the funding problems, the Coast Guard has endeavored to develop this nascent program in the absence of a broader DHS UAS strategy. Without a department-wide UAS strategy, agencies such as the Coast Guard have been left to forge a unilateral approach to develop unmanned systems and have struggled to align UAS program objectives with the overall DHS mission. This has contributed to a lack of support from DHS for funding which has left the program years behind schedule.

While the Coast Guard's vision of an integrated UAS fleet is admirable, analysis will show the Coast Guard's UAS strategy to be deliberately cautious and risk adverse. This wait-and-see approach reflects previous experience with failed acquisition efforts and a sense of uncertainty in the present strategic environment. While the current acquisition approach strives to balance enormous strategic challenges and resource constraints, this path is far too risk adverse at the expense of operational capabilities needed to meet the Coast Guard's missions. If the Coast Guard is to remain the nation's most essential maritime security force, it needs to pursue a well-defined strategy based on ends, ways, and means; one that is capable of adjusting to whatever strategic environment emerges.

Thesis

The Coast Guard UAS strategy should be modified by committing to an effort that builds upon established tactics, procedures, and techniques to create a UAS fleet capable of both land and maritime operations. The following recommendations summarize specific actions aimed at efficiently integrating the UAS program into the fleet, while also accommodating the fiscal challenges of the present and the future.

Combine Customs and Border Patrol and Coast Guard Land-Based UAS Programs

Coast Guard and CBP are pursuing UAS maritime strategies that are complementary in nature. This strategic overlap becomes more apparent as the two DHS service components continue to work closely together. A combined program will integrate and synchronize common Coast Guard and CBP functions and mission areas. UAS integration will enhance DHS missions while reducing redundancy between the two programs.

Develop a Department of Homeland Security UAS Strategic Roadmap

A DHS UAS strategic roadmap should establish intra-agency goals to leverage shared strategies and joint capabilities across similar mission sets. Without a clearly defined UAS strategic roadmap, which links platform capabilities (resources) and service initiatives (means) to defined missions (goals) of DHS and national-level strategies and policy, the risks of changing fiscal and political environments will continue to threaten the Coast Guard UAS program.

Pursue the Small Tactical Cutter-Based UAS as Part of the Coast Guard UAS Strategy

Although the small tactical UAS (STUAS) platforms typically deliver less capability than optimally required, this UAS would meet most Coast Guard needs with far less risk than a larger, more complex, and more expensive UAS solution. STUAS platforms have been operationally proven in the maritime domain by the Navy, and the Navy is expanding the role that STUAS platforms play as part of the Navy's UAS strategy. By working with the Navy on this STUAS program, the Coast Guard would be able to leverage the enhanced capabilities of STUAS platforms and gain critical UAS

operational experience. The benefits of STUAS platforms include adaptability to the maritime environment, technological maturity, and interoperability with DOD programs. As an intelligence, surveillance, and reconnaissance (ISR) platform, it is capable of faster acquisition, lower long-term program risk, while costing less to employ and operate.

Plan of Development

This thesis will briefly examine the background of the Coast Guard and its post 9-11 missions and roles. Next, the thesis will explore the UAS program's link to the origin of the Coast Guard's problematic Deepwater Acquisition program to clarify the many challenges that have hindered the successful development of the UAS program.

This background information sets the stage for conducting a strategic formulation process of the Coast Guard's UAS program. This process will provide a structured analysis of the Coast Guard's strategic interest, a look at the current strategic environment, and an analysis of the current UAS strategy using an ends, ways, and means approach. Key strategic factors which are influential for success in developing a robust UAS program will be identified. Strategic risk will be conceptually analyzed and an action plan will be presented, with recommendations for a modified UAS strategy to improve the likelihood of program success.

CHAPTER 2: BACKGROUND

Coast Guard History

The Coast Guard is a multi-mission, maritime military service. In 1787, the Secretary of the Treasury Alexander Hamilton proposed the formation of a maritime service to assist in collecting the nation's tariff and customs duties. In 1790, Congress established the Revenue Marine (later called the Revenue Cutter Service) under the Department of Treasury. Over the next eight years, the Revenue Cutter Service was the nation's only naval force and thus took on military duties to protect the fledgling nation. In 1797, Congress authorized the newly created Navy to be augmented with the revenue cutters in preparation for the Quasi-War with France. During the War of 1812, revenue cutters were again absorbed into the Navy, where one cutter swiftly captured the first British prize of war. In 1832, Treasury Secretary Louis McLane ordered the Revenue Cutter Service to begin limited cruising of the coasts in the winter months to assist mariners in distress. In 1861, the Cutter *Harriet Lane* fired the first naval shots of the Civil War in Charleston, South Carolina.[1]

Over time, the service was merged with, or took over, the responsibilities of other federal agencies, including the U.S. Lighthouse Service, Steamboat Inspection Service, and Bureau of Navigation. New missions would also emerge, such as the International Ice Patrol, brought on by the sinking of the *Titanic* in 1912. In 1915, Congress passed legislation creating the U.S. Coast Guard by combining the Revenue Cutter Service and

[1] U.S. Coast Guard, *Coast Guard Publication 1*, (Washington, DC, May, 2009), 1, 24-31.

the Life-Saving Service.[2] The legislation dictated that the Coast Guard shall…

> constitute a part of the military forces of the United States and which shall operate under the Treasury Department in time of peace and operate as a part of the Navy, subject to the orders of the Secretary of the Navy, in time of war or when the President shall so direct.[3]

Only two years after the Coast Guard was formed, World War I began, and in April, 1917 the service was transferred to the Navy. Leading up to World War II, in November 1941, President Franklin Roosevelt again transferred the service to the Navy. Moving further into the 20th century, the Coast Guard was performing so many varied maritime missions that it did not fit well under one federal department. By this time, the service had lost its traditional link with collecting revenue for the Treasury Department. A more perfect fit was found in 1967 when the Coast Guard was incorporated into the Department of Transportation to reflect the service's critical role in protecting the nation's maritime transportation routes.[4]

Following the events of September 11, 2001, Congress passed the Homeland Security and Maritime Transportation Security Acts of 2002 and transferred the Coast Guard into the newly established Department of Homeland Security (DHS).[5] While not substantially altering the roles and missions of the Coast Guard, this new legislation enabled a major shift in mission focus and priorities. A post 9/11 environment placed renewed emphasis on prioritization and resourcing of capabilities to combat terrorism by enhancing domestic and international maritime safety and security. Renewed emphasis

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[2] U.S. Coast Guard, *Publication 1*, 36-38.

[3] U.S. Coast Guard, "Bill Constituting the Revenue Cutter Service," http://www.uscg.mil/history/regulations/USCGBill.asp (accessed Apr 12, 2011).

[4] U.S. Coast Guard, *Publication 1*, 39-49.

[5] Ibid, 49-50.

was on the Coast Guard as the lead federal agency responsible for the protection of a massive network of ports, coastlines, and waterways.

DHS was created by bringing together over 200,000 personnel from across 22 separate agencies, all under one organizational umbrella.[6] This was the largest government reorganization since the creation of the Department of Defense in the late 1940s.[7] Unlike other organizations, the Coast Guard retained its existing command and control structure and reported directly to the Secretary of DHS.

As one of the five U.S. Armed Forces, the Coast Guard has fought in every major conflict since the Quasi-War with France in 1797. While search and rescue is its most visible mission, the Coast Guard conducts ten other statutory missions including marine safety, ice operations, marine environmental protection, aids-to-navigation, drug interdiction, maritime law enforcement, and defense readiness. These vast responsibilities and the requirements to integrate with numerous government agencies have defined the Coast Guard's multi-mission character and exemplified the service's motto, *Semper Paratus* - Always Ready.

Deepwater: The Acquisition Strategy

Beginning in 1996, the Coast Guard began to plan for a major recapitalization of its existing cutter fleet. During this time, the Coast Guard recognized that most vessels within the current deep water cutter fleet would reach their end of service life

[6] Homeland Security Act of 2002, Public Law 107-296, 107th Cong., (Nov. 25, 2002).

[7] U.S. Department of Homeland Security, *Civil Defense and Homeland Security: A Short History of National Preparedness Effort*, Homeland Security National Preparedness Taskforce (Washington, DC, 2006), 27, http://training.fema.gov/EMIWeb/edu/docs/DHS%20Civil%20Defense-HS%20-%20Short%20History.pdf (accessed Mar 27, 2011).

simultaneously within the next ten years. In addition, analysis of existing assets showed that the service's aircraft and communications equipment were also approaching their end of service lives. Rather than developing individual asset acquisition plans, the Coast Guard decided on a comprehensive system-of-systems acquisition approach. To the Coast Guard, "a system-of-systems is a set or arrangement of assets that results when independent assets are integrated into a larger system that delivers unique capabilities."[8] The idea was that the new Coast Guard as a whole would be greater than the sum of its parts. This new approach to acquisition was called the Deepwater Capability Replacement Project, which established a goal of replacing or modernizing the Coast Guard's 92 cutters, 209 aircraft, and procuring other capabilities such as a UAS system, and command and control communication suites.[9]

The Deepwater project was the largest acquisition endeavor ever undertaken by the Coast Guard. In this all in approach, Coast Guard dictated the performance or outcomes of assets required; the contractor proposed how to meet these outcomes using an optimal mix of assets or capabilities. The intent of the system-of-systems approach was to avoid stove-piping the acquisition process, where each class of assets is procured separately and as a result, are often unable to operate optimally with one another.[10]

However, the interlinked system-of-systems acquisition was seen as being more vulnerable to delays and fiscal uncertainties than a set of independent, yet cross-

[8] U. S. Government Accountability Office, *Coast Guard: Deepwater Requirements, Quantities, and Cost Require Revalidation to Reflect Knowledge Gained*, Report to Congressional Committees, U.S. GAO (Washington, DC, Jul, 2010), 4.

[9] U. S. Government Accountability Office, *Coast Guard: Progress Being Made on Deepwater Project, But Risks Remain*, Report to Congressional Requesters, U.S. GAO (Washington, DC, May, 2001), 1.

[10] U. S. Government Accountability Office, *Coast Guard: Deepwater Requirements*, 4.

supporting, individual system acquisitions. Similarly, a GAO report reviewing Deepwater summarized the Coast Guard's approach as "risky [due to] the unique, untried acquisition strategy for a project of this magnitude."[11] The report cited "affordability [as] the biggest risk for the Deepwater Project" and that failure of one element could have catastrophic consequences for the system as a whole.[12] Schedule delays, funding problems, or changes in design or capabilities of one asset would increase the chances that the entire process could be shutdown.[13] GAO warned that if the performance-based acquisition was not managed properly, there was increased risk that assets could be delivered late, exceeding cost estimates and not meeting quality standards. Because of the interconnectedness essential to the design and production of such a program, GAO also warned that the Coast Guard would be hard-pressed to reject any individual component of the system. Despite these concerns, the Coast Guard believed that the risks were worth the rewards.[14]

In June 2002, the Coast Guard awarded the Deepwater contract to Integrated Coast Guard Systems (ICGS), which is a joint partnership of Northrup Grumman and Lockheed Martin. Recognizing the massive complexity of the project, and realizing that the Coast Guard did not have the acquisition experience to manage such a large project, ICGS was designated as the lead systems integrator. As such, ICGS was responsible for

[11] U. S. Government Accountability Office, *Coast Guard: Progress Made*, 9.

[12] Ibid.

[13] A 1999 report on the Deepwater program written by the author, while as a Coast Guard Academy cadet, cited the inherent flaws in a system that is so dependent on other systems and long term recurring funding. See John Egan, *The Failure of Deepwater*, (New London, CT, U.S. Coast Guard Academy, 1999).

[14] U. S. Government Accountability Office, *Coast Guard: Observations on Changes to Management and Oversight of the Deepwater Program*, Testimony by Stephen Caldwell to the House Subcommittee on Coast Guard and Maritime Transportation, Committee on Transportation and Infrastructure, U.S. GAO (Washington, DC, Mar 8, 2007), 1-11.

selecting and designing, constructing, deploying, supporting, and integrating the Deepwater assets into a system-of-systems that the Coast Guard would then receive as a single integrated package ready for employment. ICGS was provided with broad service performance specifications to be used to determine and design the assets needed, based on existing and emerging off-the-shelf technologies and industry practices. The contract was awarded as an all-encompassing package, with each capability or system acting as an integral part of other systems or assets within the complete system.[15]

[15] U. S. Government Accountability Office, *Coast Guard: Deepwater Requirements,* 3-10.

CHAPTER 3: THE DEEPWATER STRATEGY FOR UAS

The Deepwater contract specified the delivery of 69 cutter-based UAS platforms at an estimated cost of $425 million, with the first delivery to occur in 2006.[1] The cutter-based UAS system was a key component and force multiplier of the Coast Guard's new National Security Cutter (NSC) and Offshore Patrol Cutter (OPC), intended to provide broad, continous over-the-horizon maritime surveillance. Maritime surveillance and Maritime Domain Awareness (MDA) are considered key capabilities that the Coast Guard needs to prosecute its 11 statutory missions.[2] The Deepwater program was the Coast Guard's UAS acquisition strategy to build these capabilities.

The U.S. maritime domain encompasses over 95,000 miles of coastline, including 12,400 miles of maritime borders.[3] To ensure the safety, security, and stewardship of the maritime domain and protect the maritime borders, the Coast Guard, DHS, and other agencies use a layered security strategy that aims to project the nation's border security outward from its shores. MDA refers to "the effective understanding of anything associated with the global maritime domain that could impact the security, safety, economy or environment of the United States."[4] MDA does not eliminate risks or hostile acts, but it provides situational awareness through interagency intelligence sharing and

[1] These were originally described as Vertical Unmanned Aerial Vehicles (VUAVs). VUAS or VUAV platforms are launched and recovered from ships or cutters rather than land. The Coast Guard now refers to VUAS or VUAV as cutter-based UAS.

[2] The Coast Guard's eleven statutory missions are: Search and Rescue; Marine Safety; Ice Operations; Aids to Navigation; Ports, Waterways, and Coastal Security; Marine Environmental Protection; Living Marine Resources; Other Law Enforcement; Defense Readiness; Migrant Interdiction; Drug Interdiction.

[3] U.S. Coast Guard, *Strategy for Maritime Safety, Security, and Stewardship* (Washington, DC, 2007), 23; U.S. Coast Guard, *2010 Posture Statement* (Washington, DC, 2010), 11.

[4] U.S. Coast Guard, *2010 Posture Statement* (Washington, DC, 2010), 27. The Coast Guard Posture Statement is an in depth review of: prior year Coast Guard performance data, current state of the Coast Guard, and desired strategic direction with next fiscal year's budget in brief. It is released yearly.

identifying risk and threats.[5] Achieving and enhancing surveillance and awareness in the maritime domain is one of the Coast Guard's strategic priorities, and is in support of higher level national strategic objectives.[6]

The Coast Guard's strategic interest, as it applies to developing a UAS program, is to provide a more robust capability of achieving strategic MDA through enhanced ISR capability. The Coast Guard has focused efforts in promoting this strategic interest primarily through three UAS objectives. First, UAS platforms provide a compelling capability to enhance MDA. UAS capabilities would provide a larger and more complete picture of the maritime domain, resulting in near, mid, and far-term wide-area surveillance and MDA across nine of eleven USCG statutory missions.[7]

Second, as part of Deepwater's system-of-systems concept, UAS capabilities also uniquely contribute to the surveillance capabilities of the Coast Guard's National Security Cutter (NSC) as part of an integrated force package. The NSC would have the ability to carry up to two cutter-based UAS platforms and one HH-65 helicopter. This capability would provide a surveillance coverage area of approximately 58,160 square nautical miles, far exceeding the 13,500 nm coverage area of the legacy High Endurance Cutter (HEC) with one embarked helicopter.[8] This increase in the NSC's performance was possible only with the supporting capabilities of UAS platforms (See Illustration D).

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[5] U.S. Coast Guard, *2010 Posture Statement*, 27

[6] Maritime Domain Awareness is one of six strategic priorities listed in the Coast Guard Strategy and a part of four strategic priorities listed in the 2010 Coast Guard Posture Statement. MDA initiatives support other higher level strategies such as the 2010 Quadrennial Homeland Security Review, DHS Bottom-Up Review, and the National Strategy for Maritime Security.

[7] U.S. Coast Guard, *Concept for Operations for the Land-Based UAS*, (Washington, DC, 2010), 1-1, 2-1.

[8] U. S. Department of Homeland Security, *U.S. Coast Guard's Acquisition of the Vertical-Takeoff-and-Landing Unmanned Aerial Vehicle*, Office of Inspector General (Washington, DC, Jun 24. 2009), 1-2.

In this respect, the Coast Guard has directly tied the performance capabilities of the NSC to those of the UAS through surveillance coverage area. This was a critical link in the Deepwater system-of systems concept and enabled the Deepwater program to propose a fleet mix which replaced the Coast Guard's twelve HECs with eight NSCs.

Lastly, based on the original Deepwater Mission Analysis Report from 1995 (revalidated through subsequent risk assessments and reports), the Coast Guard has identified operational gaps between current and required capability to complete Coast Guard missions.[9] These assessments and reports specifically identify an aviation maritime patrol hour (MPH) gap and demonstrate that as future demand for Coast Guard services is expected to increase, the MPH gap is growing. This gap represents a significant threat to the nation's maritime safety and security. The Coast Guard is looking towards UAS as a key component to reduce this MPH gap (See Appendix C & D).

Though the three UAS objectives differ, all directly contribute to enhancing the Coast Guard's initiative to build a better awareness and surveillance of the maritime domain, and thus affect national level intelligence and security. Deepwater was the Coast Guard's strategy to achieve these three UAS objectives and realize the strategic interest of enhanced MDA through UAS platforms.

Setbacks

From the onset of the signing of the Deepwater contract, the Coast Guard encountered challenges. Original service performance specifications and goals had been

[9] Some of the reports outlining the operational gaps include: Deepwater Mission Analysis Report (1995), Coastal Zone Mission Analysis Report (1999), Interagency Task Force on the Roles and Missions for the U.S. Coast Guard (2000), Mission Need Statement for Integrated Deepwater System Update (2004), Revised Deepwater Implementation Plan (2005), and the Operational Gap Analysis Report (2007).

developed prior to September 11th and were not updated to account for new homeland security responsibilities until 2005. Furthermore, the Coast Guard's move to DHS created additional program management challenges and cast a growing amount of uncertainty on the program. DHS deferred decision authority for the purchase of individual assets for the Deepwater program to the Coast Guard. Directed to manage this immense program, the individuals from the service found themselves acting "as 'team members' rather than as managers with full authority over all project decisions."[10] This lack of contractor oversight inevitably led to cost overruns, poor asset design and interoperability, and the use of unproven or inoperative technologies.

These problems cast a larger shadow over the cutter-based UAS program. As such, the cutter-based UAS project did not receive funding in 2003, because Deepwater was not fully funded, and existing funds were used for higher priority projects. The project only received partial funding from 2004-2006, and was now behind schedule and underdeveloped. As a result, the Coast Guard decided to scale back the delivery contract to just one UAS, and divided the acquisition into three separate phases: development, production, and demonstration.[11] In April 2006, the only cutter-based UAS prototype, the Eagle Eye, crashed during a test flight, halting further UAS program development.[12]

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[10] U.S. Congress, House Committee on Transportation and Infrastructure. *A Review of Coast Guard Acquisition Programs and Policies*, Summary of Subject Matter for the Subcommittee on Coast Guard and Maritime Transportation, 111th Cong., Mar 9, 2010, 6.

[11] U. S. Department of Homeland Security, *Acquisition Unmanned Aerial Vehicle*, 1-2.

[12] Geoff Fein, "Coast Guard Needs Short-Term Strategy to Fill UAV GAP, DHS IG Report Says," *Defense Daily*, Jul 23, 2009, http://www.defensedaily.com/publications/dd/7564.html (accessed April 10, 2011).

Deepwater Cancellation

In 2006, other major problems with the Deepwater program surfaced. The major acquisition of two classes of cutters was halted due to technical concerns from hull deformations and structural issues.[13] Delays in the Deepwater acquisition project as a whole and funding constraints created sustainment challenges for legacy air assets as well as delays in the acquisition of new aircraft. The House Committee on the 2010 DHS Appropriations Act noted that the MPH deficiency gap is growing as the "Coast Guard's available maritime surveillance hours will only be at approximately 65 percent of stated mission needs."[14] The end result is reduced presence over water and a reduction in performance across several mission areas, and an inability to provide maritime domain awareness in critical operational areas.[15] In April 2007, the Coast Guard announced major changes to its management of Deepwater, abandoning the system-of-systems approach for a more traditional individual asset procurement effort. The Deepwater acquisition program would live on, not as an integrated system, but as separate acquisition programs, each vying for scarce acquisition dollars.

Additionally, the Coast Guard took the role as lead systems integrator and assumed responsibility for all life cycle functions of assets.[16] This was an admission that major reforms of the acquisition program were needed. Two months later, after spending

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[13] U. S. Coast Guard, "Coast Guard Suspends Converted Patrol Boat Operations," U. S. Coast Guard Press Release, Nov 30, 2006, http://www.piersystem.com/go/doc/786/138897/ (accessed Nov 23, 2010).

[14] Ronald O'Rourke, "Coast Guard Deepwater Acquisition Programs," *Congressional Research Service* (Washington, DC, Mar 30, 2010), 25.

[15] U.S. Coast Guard, *Land-Based UAS*, 1-4.

[16] U.S. Congress, House Committee on Transportation and Infrastructure. *Coast Guard Acquisition Programs*, 6.

over $113 million on UAS preproduction and research, the Coast Guard terminated its UAS program, citing "development risks and a lack of funding."[17]

The lack of a cutter-based UAS platform reduced the intended maritime surveillance area of the National Security Cutter (NSC) from 58,000 square miles to 18,300 square miles; a 68 percent reduction.[18] This reduction created a maritime surveillance gap, which put into question the operational usefulness and merit of the service's future cutters. As the system-of-systems approach of the Deepwater program was abandoned, an unfortunate byproduct was the recycling of the UAS program.

Moving Forward

Though the UAS contract was terminated, efforts had to continue to find a viable replacement solution for the capabilities that UAS platforms were to provide. Although it was the smallest program of the Deepwater project, Coast Guard officials claimed it was the most important. Echoing this sentiment, a DHS Inspector General report cited the cutter-based UAS program as "a key component of the Deepwater contract."[19]

In 2008, the Coast Guard completed a UAS Path Forward Study, which determined that both cutter-based and land-based UAS platforms would complement existing and emerging surface and air assets in prosecuting Coast Guard missions, particularly in providing cost effective maritime surveillance and detection.[20] The Coast Guard used this study as the strategic basis for its UAS acquisition efforts (See

[17] U. S. Department of Homeland Security, *Acquisition Unmanned Aerial Vehicle*, 1-3.

[18] Ibid.

[19] Ibid.

[20] U.S. Department of Homeland Security, *Unmanned Aircraft Systems: Fiscal Year 2010 Report to Congress*, U. S. Coast Guard (Washington, DC, Apr, 2010), ii.

Illustration A). However, with no funding allotted to the program and no experience in building a UAS force structure from the ground up, the Coast Guard would have to lean on the expertise of other organizations. The Coast Guard's Research and Development arm established partnerships with the Navy, Customs and Border Patrol (CBP), and commercial technical authorities to evaluate current and emerging UAS technologies, systems and operations integration, and dynamic interface testing.

CBP had begun a successful UAS program centered on the land-based MQ-9 Predator-B. The Predator-B flew in support of law enforcement operations over the Southwest U.S. border and was first employed in 2005 as part of the DHS Secure Border Initiative (SBI). Encouraged by this success, CBP began plans for expanding UAS operations to cover the maritime domain as well. Here was a strategic opportunity to leverage existing UAS knowledge and build partnerships. The Coast Guard and CBP formed a UAS Joint Program Office in 2008 to assess and identify UAS maritime requirements, technology challenges, maritime operational concepts, logistics, and training. The Coast Guard envisioned land-based UAS platforms to provide strategic persistent wide-area surveillance capability in the maritime domain (See Illustration B). The intent of this partnership was to ultimately establish an organic UAS force structure for the Coast Guard. [21]

Concurrently, the Coast Guard continued research and testing of a maritime cutter-based UAS and found an ideal partner with the U.S. Navy, which was testing its own maritime UAS, the Fire Scout. The similar UAS mission requirements made this an

[21] Daniel Baxter, "Predator B Guardian To Use For Counter Narcotics Operations," Aviation Online Magazine, Dec 10, 2009, http://avstop.com/news2/predator_b_guardian_to_use_for_counter_narcotics_operations.htm (accessed Aug 18, 2010).

ideal partnership for the Coast Guard (See Illustration C); however, a cutter-based UAS platform had not yet been technologically proven and operations in the maritime environment presented unique challenges. With knowledge of the past difficulties and future challenges ahead, the Coast Guard slowed to a "wait and see" approach, letting the Navy do the bulk of the research and investment. Alluding to the Coast Guard's recent-failed UAS program, Rear Admiral Gary Blore, Chief of the Coast Guard's Acquisitions Directorate explained this slowed approach, "We got led astray with our previous [UAS] project. We want to make sure that doesn't happen again."[22]

Fundamental changes to the Deepwater program cast light upon a dramatically changed and evolved strategic environment. This change necessitated clear strategic guidance and direction. Strategy is subservient to the strategic environment. The Coast Guard was in need of a dedicated UAS strategy.

[22] Philip Ewing, "Coast Guard Hopes for UAV by Around 2014," *Navy Times*, Feb 12, 2008, http://www.navytimes.com/news/2008/02/coastguard_acquisitions_080211w/ (accessed Apr 12, 2011).

CHAPTER 4: THE COAST GUARD UAS STRATEGY

Understanding the background of the troubled Deepwater acquisition program and how it is linked to the challenges of developing the UAS program serves as a basis for understanding the Coast Guard's new UAS strategy. Deepwater now existed as a name for a collection of individual acquisition programs, all competing in a growing fiscally-constrained environment. External and internal politics influenced and advanced acquisitions of larger assets. As funding became available, the recapitalization of major cutters took priority over the nascent and technologically challenged UAS program. Nevertheless, new ways ahead emerged by forging partnerships with the Navy and CBP, and expanding Coast Guard UAS research. The Coast Guard was placing increasing emphasis on the more technologically-developed land-based UAS platforms, not just as a means for closing the MPH gap, but also as a long term solution to providing MDA.

In January 2009, the Coast Guard for the first time, developed and documented its UAS strategy in an effort to articulate the shift in Coast Guard efforts to procure a UAS force (See Appendix A). The strategy was signed by the DHS Deputy Secretary and outlined the need to procure cutter-based and land-based UAS platforms to support Coast Guard missions. This strategy stressed the Coast Guard's requirements for Persistent Wide Area Surveillance. This is a critical element of Maritime Domain Awareness (MDA), which the Coast Guard is currently unable to fully support because of gaps in the aviation wide area surveillance capacity.[1]

[1] U.S. Coast Guard, *Coast Guard Unmanned Aircraft System (UAS) Strategy* (Washington, DC, Jan 12, 2009), 1-2. See Appendix A.

The UAS strategy detailed strategic efforts to pursue three classes of UAS platforms: tactical cutter-based, tactical land-based, and strategic high altitude. The strategy emphasized the Coast Guard's ongoing partnership with the Navy in developing the Fire Scout UAS and with CBP in deploying the Predator-B UAS; however, it also recognized that further research, development, and operational testing and evaluation was necessary to determine the most effective UAS platform for meeting Coast Guard mission requirements. Pursuit of high altitude UAS program would be enabled by the Navy's Broad Area Maritime Surveillance Program through subscription to a wide area network of UAS surveillance data. The strategy listed four points of emphasis: commonality with DOD and DHS programs, ensuring technological and production maturity, continuing research leading to advanced technology demonstrations or low rate production to mitigate production risk, and leveraging other organization's UAS development and engineering costs.[2]

This strategy attempted to frame the Coast Guard's near-term objective of obtaining a land-based and cutter-based UAS force structure as a means to employ ISR capabilities to achieve Maritime Domain Awareness. ISR capabilities are a critical element of developing an effective MDA, and the strategy described the use of these capabilities as a "least cost, best value" solution to maritime surveillance.[3]

This strategy reflected the Coast Guard's efforts at the time in developing its UAS program. It captured many of the efforts and implied strategies originating from the original Deepwater program, and formalized them into a strategic request for program funding and development. However, this strategy did not address the technological

[2] U.S. Coast Guard, Unmanned Aircraft System Strategy, 1.

[3] Ibid.

complexities of the systems involved, which are necessary to operate unmanned aircraft. UAS platforms are multifaceted systems with expensive supporting, technological, and behind the scenes operating costs. This casts doubt that UAS platforms are indeed a "least cost, best value" solution.

The strategy also did not address the ramifications of the existing maritime surveillance gap, or measures to close this gap. According to the Coast Guard's Deepwater performance baseline, maritime surveillance describes a criterion for measuring the new National Security Cutter's (NSC) system level performance.[4] It is not clear if the Coast Guard intentionally omitted references to the maritime surveillance gap, but addressing this issue would highlight a significant performance shortfall of the Coast Guard's newest and most capable cutter.

Short Term Strategy

In 2009, the DHS Inspector General reported on the Coast Guard's cutter-based UAS program and cited the need for the Coast Guard to document its short-term strategy to address the maritime surveillance gap resulting from the lack of a fielded UAS force. The Coast Guard concurred with the IG's recommendation and stated that support for the National Security Cutter will be based on the "operational commander's priorities" to meet the strategic direction of the service.[5] Elaborating, the Coast Guard placed

[4] U. S. Government Accountability Office, *Coast Guard: Deepwater Requirements, Quantities, and Cost Require Revalidation to Reflect Knowledge Gained*, Report to Congressional Committees, U.S. GAO (Washington, DC, Jul, 2010), 23-24.

[5] U. S. Department of Homeland Security, *U.S. Coast Guard's Acquisition of the Vertical-Takeoff-and-Landing Unmanned Aerial Vehicle*, Office of Inspector General (Washington, DC, Jun 24. 2009), 1-2.

emphasis on the use of a mix of manned aircraft to meet operations, on a risk-based, priority basis without adversely impacting current operations. [6]

This strategic shift represented a rational way to mitigate current risk, as far as maritime surveillance was concerned; however, this strategic view did not provide information regarding implementation efforts and how those efforts would *not* affect current Coast Guard operations. This paradigm implied that the Coast Guard could conduct adequate maritime surveillance based on current operational performance. This strategic shift did not address the consequences of deteriorating operational performance; especially as legacy cutters are replaced by fewer National Security Cutters and Offshore Patrol Cutters, which lack a greater maritime surveillance capability. As performance continued to deteriorate, numerous alternate means would be required to provide adequate maritime surveillance.

The growing maritime surveillance gap and its potential impact on MDA would cause the Coast Guard to miss many yearly performance goals. For example, researchers at the Center for American Progress cited the Coast Guard's recent reduction in its cocaine removal target performance measures as an effort to "avoid a significant drop-off in service delivery due to lack of capacity. So while performance targets might be met on paper in the next fiscal year, the service's real effectiveness on the ground will actually decrease."[7]

Representative Elijah Cummings (D-MD), chairman of the Subcommittee on the Coast Guard and Maritime transportation, echoed similar comments in a recent hearing

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[6] U. S. Department of Homeland Security, *Acquisition Unmanned Aerial Vehicle*, 1-2.

[7] Lawrence Korb, Sean Duggan, and Laura Conley, "Building a U.S. Coast Guard for the 21st Century," Center for American Progress, Jun 9, 2010, 12, http://www.americanprogress.org/issues/2010/06/pdf/coast_guard.pdf (accessed Sep 12, 2010).

where he stated "in plain English, according to the Coast Guard's own performance measures, reduced patrol hours will likely mean that fewer drugs will be interdicted at sea."[8] In this specific instance, recent performance numbers showed that the Coast Guard, in fact, did *not* meet the already reduced performance target for cocaine removal in 2009. The Coast Guard responded that "the deviation from target was minor and there was no effect on overall program performance."[9] While this may be the case, future yearly evaluations of Coast Guard performance goals will determine if a lack of capacity and capabilities, such as having UAS platforms, are indeed leading to a dangerous degradation in service performance.

Fleet Mix Analysis

In 2009, the Coast Guard began conducting a fleet mix analysis (FMA) report which was to be essential for charting the future course of the Coast Guard. The FMA report would "quantify changes made to the original Deepwater program…including unmanned aircraft surveillance" to identify mission demands and validate Deepwater system and asset capability requirements.[10] This would lead to the identification of current and emerging operational gaps in performance, such as maritime surveillance, and recommendations to close the gaps, including the operational use of UAS platforms.

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[8] Elijah Cummings, Coast Guard FY 11 Budget Request before the House Subcommittee on the Coast Guard and Maritime Transportation, in Proquest, Feb 25, 2010 http://proquest.umi.com/pqdweb?index=0&did=2301762801&SrchMode=2&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1307470004&clientId=3921 (accessed Jan 12, 2011).

[9] U. S. Department of Homeland Security, *Annual Review of the United States Coast Guard's Mission Performance (FY 2009)*, Office of Inspector General (Washington, DC, Aug, 2010), 28.

[10] U. S. Department of Homeland Security, *Acquisition Unmanned Aerial Vehicle*, 7.

Although the FMA was to be completed in July 2009, the study did not impose financial constraints in its analysis. Service officials later determined that results of the report were not feasible. The Coast Guard is currently conducting a second fleet mix analysis (FMA II), which is a cost-constrained capability needs analysis that will validate mission needs, roles, and responsibilities, and will produce recommendations on the number and type of surface assets that the Coast Guard should procure. According to one Coast Guard official, the report, currently in draft form and over 1,600 pages "will be essential for funding acquisition projects to meet the needs of the Coast Guard." [11]

The FMA II report will likely be the cornerstone document that describes the current and future operating landscape that will in turn dictate needed Coast Guard capabilities. It is likely that the report will serve as a new strategic document to guide future individual Deepwater programs. The FMA II report was to be released in the summer of 2010, but for unknown reasons, the Coast Guard has not yet released the report. It is unclear what impact the report will have on the UAS program. [12]

Partnerships Advance UAS Efforts

The Coast Guard UAS strategy specified leveraging other organizations' UAS development and engineering costs to support its own UAS development. The Coast Guard has emphasized this and made it a key aspect of its UAS acquisition process.

[11] Cdr Brendan Kelly, Deputy of Requirements and Analysis, Phone interview by author, 20 Aug, 2010.

[12] For instance, more emphasis may be placed on the need for advancing the funding of certain Deepwater assets, such as surface cutters, at the expense of other programs. Alternatively, the report could place more emphasis on ISR and Command, Control, Communication and Computer Information Technology (C4IT), which could possibly expand and fast track the UAS program.

Through CBP and Navy partnerships, the Coast Guard has qualified the first of several operational pilots for both the land-based Predator-B and the cutter-based Fire Scout. The Coast Guard has also established a UAS training and standards command and has recently qualified several UAS sensor and maintenance operators. Senior leadership and staffing level billets were created with CBP and the Navy to further relationships, collaboration, and enhance research and development among the agencies. In addition, a liaison office with the FAA was established to advocate the Coast Guard's interests in shaping UAS airspace regulation.

Land-based UAS

Customs and Border Patrol Guardian UAS
DHS File Photo

In December 2009, the Coast Guard and CBP partnership soon led to CBP taking delivery of the first Maritime Variant Predator, aptly named the Guardian. The Guardian included numerous upgrades to meet maritime operational requirements and to withstand the harsher marine environment. Joint developmental and operational testing was conducted in early 2010. Major General Michael Kostelnik, USAF (Ret.), Assistant Commissioner for CBP Air and Marine, testified to Congress that the test results indicate

that the Guardian "will provide DHS with an impressive capability for maritime surveillance and interdiction missions."[13]

Since conducting testing operations, CBP and the Coast Guard have flown the Guardian operationally several times, including surveillance operations in support of the Deepwater Horizon Oil Spill cleanup efforts. Both agencies are planning to conduct the first joint CBP/USCG deployment of the Guardian to Central America to support counter-illicit trafficking efforts, while also continuing maritime testing and evaluation.

Testifying before Congress, General Kostelnik explained how CBP's strategic vision to acquire 24 Predator-B based UAS platforms would provide the capability to be anywhere within the continental United States within three hours. This capability, in concert with CBP's manned aviation, would provide a "complete water security net."[14] Going forward, CBP's UAS strategy will hinge upon building on the success of the Predator-B and Guardian UAS platforms. In January 2011, CBP took delivery of its second Guardian UAS and funding for a third is included in CBP's 2011 Presidential Budget request. Program experts from the Navy expressed positive views on the Guardian's potential for Coast Guard missions; however, they also noted that airspace safety restrictions made the UAS less operationally useful than required. They concluded that UAS acquisition efforts should be given careful consideration until technological, safety, and regulatory issues which prevent UAS platforms from flying in the national

[13] Michael Kostelnik, *The Role of UAS on Border Security*, Testimony to House Homeland Security Subcommittee on Border, Maritime, and Global Counterterrorism, U.S. Government Printing Office online, Jul 15, 2010, 13, http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg64701/pdf/CHRG-111hhrg64701.pdf (accessed Jun, 7, 2011).

[14] Ibid.

airspace are resolved.[15] These are strategically relevant issues, which serve as barriers to implementing a successful UAS strategy, and will be discussed in the next chapter on the UAS strategic environment.

Cutter-based UAS

Fire Scout Maritime UAS
U.S. Navy File Photo

For the cutter-based UAS platform, the Fire Scout continues to be the Coast Guard's lead candidate. The Coast Guard continues to work closely with and follow the lead of the Navy in developing the Fire Scout. In mid 2009, the Coast Guard conducted their first dry fit testing of the Fire Scout on the National Security Cutter (NSC), and later that year a maritime demonstration was completed to evaluate the sensor package.

The Fire Scout gained early notoriety while conducting an operational test flight from the USS *McInery* in the eastern Pacific. While testing the Fire Scout's sensors, flight crews discovered a go-fast boat laden with bales. Loitering over the scene undetected, the Fire Scout relayed video feed as the frigate closed in. A Coast Guard

[15] U.S. Navy, Letter of Observation of the Customs and Border Protection Land Based Unmanned Aircraft System, Jun 2010.

law enforcement detachment team stationed on the *McInery* confiscated over 60 kilograms of cocaine.[16] The Fire Scout recently surpassed 1,000 flight hours since the Navy's test program began in December, 2006. The Navy is planning to use the Fire Scout for two deployments for operational evaluations during 2011 in support of operations in Africa and the Middle East.[17]

Due to ongoing testing and limited resources, the Navy has been unable to lend the Coast Guard a Fire Scout for further testing. Coast Guard officials say that because of a lack of R&D funding and their reliance on the Navy, it would likely be sometime after fiscal year 2013 until a Fire Scout would be available from the Navy to allow for a technology demonstration on Coast Guard cutters.[18] Captain Matthew Sisson, Commanding Officer of the Coast Guard's Research and Development Center would not even venture a guess as to when the acquisition of the cutter-based UAS would begin.[19]

Until the Navy completes testing, the cutter-based UAS program will continue to remain in a holding pattern. While the Coast Guard is strategically leveraging the efforts of other agencies, its over-reliance on these agencies is delaying the implementation of the Coast Guard UAS strategy. This is having a negative impact on the Coast Guard's UAS program and adversely affecting maritime surveillance and Maritime Domain Awareness (MDA).

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[16] Matthew Fox. "Watching the Seas," *U.S. Coast Guard Forum*, Oct 2010, http://www.uscgf-kmi.com/cgf-home/278-cgf-2010-volume-2-issue-5-october/3449-watching-the-seas.html (accessed Apr 12, 2011).

[17] Naval Air Systems Command, "Future Capability," *Communications Vector*, 15 December 2010.

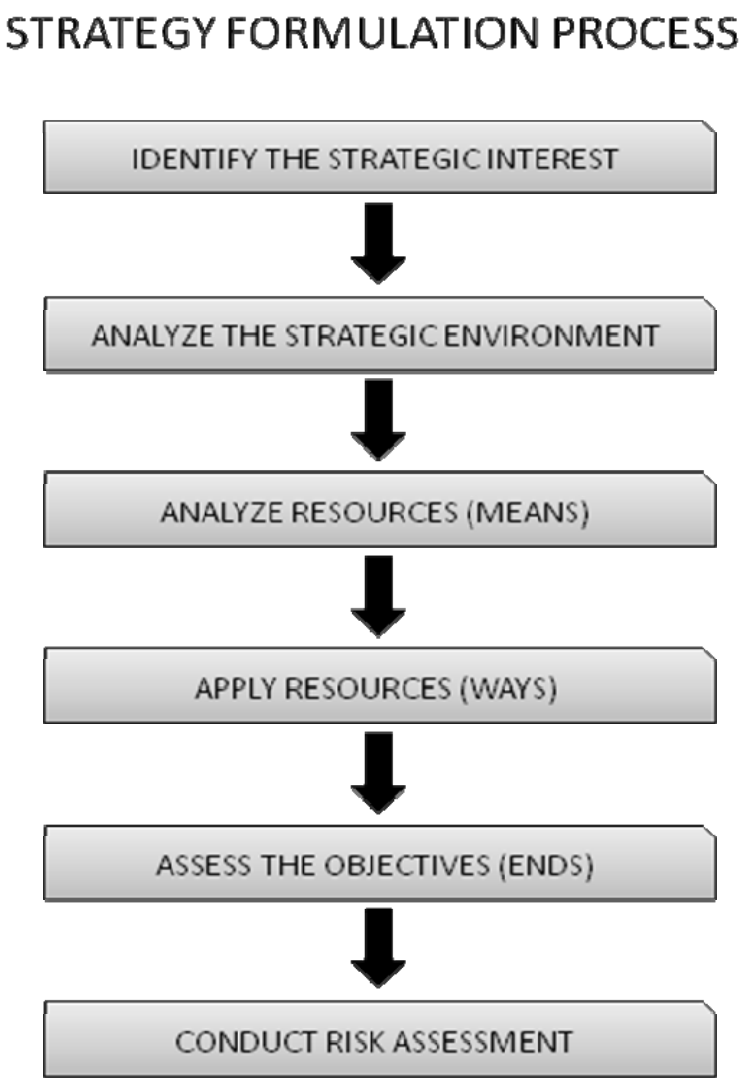
[18] LCDR Jeff Vajda, Coast Guard UAS Program Manager, phone interview by the author, 12 Jan 2011.

[19] Stew Magnuson, "For Coast Guard Remotely Piloted Aircraft Remain A Distant Goal," *National Defense*, Nov 2009, http://www.nationaldefensemagazine.org/archive/2010/November/Pages/ForCoastGuard,RemotelyPilotedAircraftRemainADistantGoal.aspx (accessed Dec 12, 2010).

Alluding to the nature of changing dynamic environments and technological uncertainties, the Coast Guard UAS strategy stated that "the goal of these projects is discovery," and that their reflexive nature may cause the Coast Guard to alter the strategy in the future to "adapt to the improved knowledge and experience."[20] The complex background and evolution of the Deepwater program and the reemerging stages of the UAS program and a Coast Guard UAS strategy provide the framework for developing a modified and more effective Coast Guard UAS strategy. A strategic formulation process in the next chapter will be used to provide a structured analysis of the strategic interest, strategic environment, and strategy development relating to the Coast Guard UAS program.

[20] U.S. Coast Guard, Unmanned Aircraft System Strategy, 1-2.

CHAPTER 5: A NEW UAS STRATEGY



Modified from Yarger's Strategy and the National Security Professional[1]

The purpose of the strategic formulation process is to provide a construct to qualify what is known or believed to be known, and what is unknown about the strategic environment. The process seeks to identify and articulate strategic interests and objectives and assign a level of importance or intensity to these interests, while also

[1] Harry Yarger, *Strategy and the National Security Professional*, in Praeger Security International online under chapter "Strategic Appraisal", subscriber content, http://psi.praeger.com/search.aspx?newindex=1&q=yarger&c= (accessed Apr 2, 2011).

identifying key strategic factors which are critical for properly formulating a viable strategy. The systematic methodology shown in the preceding diagram was adopted from Harry Yarger, strategist and professor of National Security Policy at the U.S. Army War College and the U.S. Army War College Regional Strategic Appraisal Process.[2]

The reasons for a methodical approach are many. Too often, solutions to problems are rushed before problems are fully defined and understood. We can spend 95 percent of the time working on solutions and only 5 percent of the time on defining what the scope of the problem is. A strategic formulation process lends an opportunity to spend more time on understanding what the problem is. This enables more effective and efficient solutions to be created through the development of proper strategy.

The strategic formulation process consists of identifying the objective, analyzing the strategic environment, analyzing current or needed resources (means) and how to apply them (ways) to achieve the objectives (ends), and then considering levels of acceptable risk throughout the process. A qualitative risk assessment of this strategy will be based on the Failure Mode and Effects Analysis (FMEA), which is a qualitative risk analysis used by the National Aeronautic and Space Administration. The strategic formulation process will allow a comparative analysis of the current Coast Guard UAS strategy with a recommended alternative strategy which will pose lower risk and as a result, a higher likelihood of success.

[2] Harry Yarger, *Strategy and National Security*.

Identify the Strategic Interest

The first step in strategy formulation is to identify the key interests of the Coast Guard as it relates to the UAS program and how these interests are shared with higher level DHS and national interests. Specificity is important in identifying the interests because this influences the realm and level of appropriate strategic thought. Understanding and articulating the interest aids in identifying key strategic factors, clarifies the desired end state, and focuses strategy formulation on the right balance of ends, ways, and means. It places emphasis on what the problem is, rather than jumping to solutions.

Determine the Level of Interest

Expressing the level of the Coast Guard's interest in developing a UAS program requires a thorough and developed understanding of organizational strategies and direction. Similarly, identifying this interest will also represent any affect of not having a developed UAS force and how this relates to overall Maritime Domain Awareness (MDA).

Strategic interest levels are classified as:

> **High**- Will have an immediate consequence to core interest
> **Medium**- If unfulfilled, will result in damage that will affect core interests
> **Low**- If unfulfilled will result in damage that is unlikely to affect core interests [3]

Evaluating the Coast Guard's actions in building a UAS program will also challenge current assumptions for the strategic interest of the program and demonstrate a level of the service's interest. "Levels of [interest] suggest relative importance and have

[3] Harry Yarger, *Strategy and National Security*.

temporal, resource, and risk acceptance implications," however a low level of interest does not mean that the interest will not be addressed or acted upon.[4] Using this method, the Coast Guard's level of intensity for developing the UAS program can be classified as low, as noted in the diagram and explained below.

Interest		*Desired Role*	*Challenges*	*Risk*	*Mitigation*	*Level of Interest*
	Sub-Interest					
MDA						
	UAS	•ISR capability to enhance MDA •ISR for Cutters (extend surveillance) •Close aircraft patrol hour gap	•Technology •FAA Regulations •Funding constraints •Not operationally proven	•High	•R&D •Partner w/ other agencies •Smaller UAS •Alternate MDA initiatives	•Low/ Peripheral

The Coast Guard recognizes the need for a better understanding of what happens in the maritime domain to properly inform operational direction. Maritime Domain Awareness (MDA) will require greater collection and sharing of data, and more cooperation in fusing this data into actionable intelligence. MDA is a national, whole-of-government approach to achieving a layered security strategy as well as an international activity, extending into international ocean commons and other foreign maritime domains. However, the vastness, anonymity, and limited governance of the maritime domain present daunting challenges.

Because of the complexity of MDA, there can never be 100 percent maritime domain awareness. If there cannot be complete awareness, then what level of awareness is acceptable and at what cost? Without effective partnering and cost sharing between agencies, the risk in unilaterally employing and developing MDA initiatives is high, requiring exponential cost for a comparatively marginal gain. The UAS program

[4] Harry Yarger, *Strategy and National Security*.

continues to face technological, operational, and regulatory challenges, which are not likely to be solved in the coming years. Placing emphasis on a highly technologically-driven program opens the path to numerous avenues of unnecessary risk, which require mitigation through a phased slower program approach and/or the allocation of scarce funding. From this paradigm, specific MDA initiatives have lesser importance than higher priority initiatives.

The Coast Guard has made it very clear that the service's top strategic priority is the recapitalization of its assets through the Deepwater acquisition program. This was specifically documented and emphasized in the Coast Guard's 2010 Posture Statement. In testimony to the Senate Appropriations Committee for the Coast Guard's FY 2011 budget request, Coast Guard Commandant, Admiral Thad Allen, very plainly stated the Coast Guard's budget "focuses resources on the top budget priority - continued recapitalization of aging assets and infrastructure."[5]

True to that word, in the four years since cancellation of the original UAS program, the Coast Guard has requested only $3M for the UAS program in its budget to Congress, leaving the program vastly underfunded. In this respect, the Coast Guard is contributing to MDA efforts by first emphasizing the Coast Guard's most basic need: the recapitalization of the Coast Guard fleet. Investment in the recapitalization of the Coast Guard's assets will enhance national-level MDA efforts while concurrently ensuring that the Coast Guard is able to effectively carry out its eleven statutory missions. The service has wagered its future on these assets. According to Admiral Allen, the "long-term

[5] Admiral Thad Allen, "Testimony to the Senate Appropriations Committee on the Coast Guard Fiscal Year 2011 Budget Request", U.S. Department of Homeland Security, Apr 13, 2010, http://www.dhs.gov/ynews/testimony/testimony_1271366302572.shtm (accessed Aug 5, 2010).

performance ultimately depends on the pace and stability of future recapitalization… [this] is a strategic imperative for DHS and the Coast Guard."[6]

Where does UAS fit into the Deepwater recapitalization efforts and ongoing MDA enhancement initiatives? The UAS program represents compelling ISR capabilities which enhance MDA, and feeds other maritime governance initiatives and operational capabilities. However, although part of the original Deepwater asset program, UAS is not a legacy asset; it is not replacing an aged or outdated operational asset. UAS represents a supporting component of the National Security Cutter and Offshore Patrol Cutter, but it is not part of the Coast Guard's strategic imperative to recapitalize assets. It is not a panacea to solving the Coast Guard's MPH gap, either. The Coast Guard has been operating with a significant MPH gap for over 10 years and has had limited success in efforts to reduce this gap. A new MPH requirements study, aligned with the forthcoming Fleet Mix Analysis II (FMAII), would likely better reflect the MPH requirements of a post 9-11 environment.

The potential benefits of the added capabilities from UAS platforms are sizable, however so are the unique challenges which must be overcome. The Coast Guard has weighed the risks and benefits of this technologically leveraged program, however these risks as well as competing strategic priorities and limited funding make the development of the UAS program a low priority for the Coast Guard.

[6] Admiral Thad Allen, "Coast Guard Budget Request."

The Strategic Environment

The next step in the strategic formulation process is to analyze all available information in the strategic environment that is relative to Coast Guard UAS platforms. While this is perhaps the most time consuming part of strategy formulation, developing strategy requires having a clear and complete understanding of the strategic environment and how it influences strategy.

The strategic environment is best described as an interacting living being; it is complex and chaotic, full of volatility and uncertainty, yet it is also has a level of predictability and order. It is a system which is linear and non-linear; it is a dynamic system within a system. In this sense, evaluating and understanding the Coast Guard's strategic environment requires the assessment of a vast array of information and facts, past and present, which can affect the development of the Coast Guard's UAS program.

This assessment will reveal technological, bureaucratic and fiscal strategic factors which ultimately contour and shape the strategic environment. By their nature, these key factors tend to have an overwhelming influence on the development of the UAS program as well as crafting a viable UAS strategy. Understanding the dynamics of these strategic factors will form the basis for strategy formulation and will influence the likelihood of the success of that strategy. These factors have a dramatic impact on achieving strategic objectives and thus require careful and constant analysis.

Because of the complexities of the strategic environment, the assessment of information is a continual and repetitive process. The strategic environment spans the past, present and future. Information already presented on the development of the UAS and its link to the Deepwater acquisition program serves as a foundation to understand

the strategic environment as it pertains to the Coast Guard's UAS program. However, new information will continue to shape this understanding and to identify or validate the technological, bureaucratic and fiscal strategic factors which most influence the UAS program.

Airspace Challenges and Safety Concerns

Airspace and safety concerns pose a major technological and bureaucratic hurdle to the successful implementation of a UAS program. UAS platforms are classified as aircraft and are also subject to existing flight rules and regulations, including See and Avoid.[7] In 2009, the DHS Inspector General reviewing the Coast Guard's UAS program reported that the Coast Guard needs to work with the Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO) to ensure that UAS platforms meet regulatory compliance for airspace restrictions.[8]

According to the FAA, there is currently no technology which will enable an unmanned aircraft to detect, see, and avoid other conflicting air traffic and that such a technology is "years away."[9] The DHS Inspector General reported that the Coast Guard continued its acquisition plans for the cutter-based UAS program "without assurance that the aircraft would be able to operate in a manner to meet the Coast Guard's mission needs

[7] See 14 CFR § 91.113 (b): "vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft."

[8] For example, during Deepwater development, the Coast Guard proposed developing a High Frequency Surface Wave Radar to be used on the NSC to aid in airspace deconfliction for the cutter-based UAS. However, the Coast Guard had no assurances from the FAA that this technology would meet See and Avoid regulations. Efforts to continue the development of the High Frequency Wave Radar were eventually cancelled in 2002 because of technology complications. See U. S. Department of Homeland Security, *U.S. Coast Guard's Acquisition of the Vertical-Takeoff-and-Landing Unmanned Aerial Vehicle*, Office of Inspector General (Washington, DC, Jun 24, 2009).

[9] Federal Aviation Administration, "Fact Sheet: Unmanned Aircraft Systems," FAA, Dec 1, 2010, http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=6287 (accessed Dec 12, 2010).

without restrictions."[10] Such mission needs include immediate launch and recovery; flights over the high seas and populated areas around ports, rivers and littoral waters; and operations within international and foreign airspace.

UAS platforms were fundamentally designed to operate in battle space environments which are subject to different mission requirements. In combat, UAS platforms are flown in designated airspace corridors which have been cleared of existing air traffic or by military controlling agencies. Most UAS platforms are equipped with location and altitude identifying transponders, as are other military aircraft. However, in the national and international airspace system, current flight regulations do not require all aircraft to be equipped with identifying transponders or in some instances, to have an operable radio. Even with radar coverage and transponders, the need to see-and-avoid another aircraft remains the primary means of avoiding a collision and is the sole responsibility of the pilot, whether in the cockpit or on the ground. Current technology limitations do not enable the UAS pilot on the ground to meet FAA see-and-avoid flight regulations nor allow for autonomous UAS collision avoidance, thus posing a safety threat to the National Airspace System (NAS) and to citizens on the ground.

To allow limited UAS access to the NAS, the FAA has established a Certificate of Authorization (COA) process which allows temporary UAS operations in a defined airspace, provided that the risks of flying the UAS in the NAS can be appropriately mitigated, with a ground observer, a chase aircraft, and coordination from a local FAA facility for traffic separation. Customs and Border Patrol (CBP) currently operate their

[10] U. S. Department of Homeland Security, *U.S. Coast Guard's Acquisition of the Vertical-Takeoff-and-Landing Unmanned Aerial Vehicle*, Office of Inspector General (Washington, DC, Jun 24, 2009), 1.

UAS platforms through the FAA COA process. However, without routine access to the NAS, the capabilities of UAS platforms cannot be fully leveraged.

FAA efforts to balance current UAS technologies with developing safety regulations have been hampered by the lack of actionable data in the first place. The lack of a regulatory framework for developing UAS platforms in the NAS has limited the amount of data available for further developing and refining UAS operations.[11] In recent testimony before Congress, top FAA officials explained that "because current available data is insufficient to allow unfettered integration of UAS platforms into the NAS-where the public travels everyday-the FAA must continue to move forward deliberately and cautiously, in accordance with our safety mandate."[12] To help standardize performance criteria and aid in the development of UAS regulations, in 2004 the FAA established Special Committee 203. The committee includes members from academia, DOD, FAA, and NASA and would among other things, seek to develop standards for see-and-avoid/sense-and-avoid, command and control communications, reliability, and human factors issues. However the task at hand quickly proved to be daunting.

The committee claimed that they did not realize that "developing technical standards for UASs would be a project of unprecedented complexity and scope."[13] Target completion dates for UAS technical standards have changed. Originally the committee

[11] U.S. Government Accountability Office, Unmanned Aircraft Systems: Federal Actions Needed to Ensure Safety and Expand Their Potential Uses within the National Airspace System, Report to Congressional Committees, U.S. GAO (Washington, DC, May, 2008), 23.

[12] Henry Krakowski, *Integration of UASs Into the National Airspace System: Fulfilling Imminent Operational and Training Requirements*, Testimony to Senate Committee on Commerce, Science, & Transportation, Subcommittee on Aviation Operations, Safety, & Security, FAA.gov, Jul 15, 2010, http://www.faa.gov/news/testimony/news_story.cfm?newsId=11841 (accessed Jun 7, 2011).

[13] U.S. Government Accountability Office, *UAS Federal Actions Needed*, 31-32.

was to have the standards published by 2011, but this was delayed to 2019.[14] However, recent Congressional testimony by top FAA executives outlined a more optimistic completion date sometime before 2015.[15] The Coast Guard has acknowledged that defined performance and safety criteria will influence the performance, design, equipment, and training requirements of its selected UAS and that it will monitor the results of the committee.[16] Until these technical standards can be completed and the FAA is able to incorporate them into regulations, UAS integration with the NAS may take a decade or longer to occur.[17]

In a 2008 report, GAO stated that "routine access to the national airspace system poses technological, regulatory, workload, and coordination challenges." Providing the capability for UAS platforms to meet safety requirements of the NAS is key to meeting some of these challenges, but as the FAA has suggested, the technology for this is years from development. UAS platforms "are not ready for seamless integration or routine use," explained FAA Administrator Randy Babbitt, "in order for us to get to the place where the UAS can become a viable, accepted part of the NAS, we have to make sure that, sense-and-avoid is more than a given - it must be a guarantee." [18]

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[14] U.S. Government Accountability Office, *UAS Federal Actions Needed*, 31-32.

[15] John Allen and Nancy Kalinowski, *The Role of UAS on Border Security*, Testimony to House Homeland Security Subcommittee on Border, Maritime, and Global Counterterrorism, U.S. Government Printing Office online, Jul 15, 2010, 22, http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg64701/pdf/CHRG-111hhrg64701.pdf (accessed Jun, 7, 2011).

[16] U.S. Coast Guard, *Concept for Operations for the Land-Based UAS*, (Washington, DC, 2010), 6-27.

[17] U.S. Government Accountability Office, *UAS Federal Actions Needed*, 31-32.

[18] Randy Babbitt, "Safety Must Come First," Speech to the Aerospace Industries Association, FAA.gov, Nov 18, 2009, http://www.faa.gov/news/speeches/news_story.cfm?newsId=10964 (accessed Jan 11, 2011).

GAO noted that addressing these challenges will require the "efforts of several federal agencies and could require a decade or more of additional work."[19] Similar efforts to implement collision avoidance technology currently in use took over 13 years to develop. FAA officials estimate that the cost to develop an acceptable detect, sense, and avoid system could cost up to $2 billion to complete.[20]

As it became evident that the challenges of airspace integration were not going to be solved by one agency alone, in 2009 Congress directed the FAA and DOD to establish an Executive Committee (ExCom) to study the range of policy, procedural, and technical solutions which can be used to meet the challenges of integrating UAS into the NAS.[21] NASA, CBP, and the Coast Guard have joined ExCom and will have the unique ability to influence and shape the development of UAS platforms and the NAS. UAS integration with the NAS requires the expertise and technology of several government agencies, as well as academia and state and local governments; however, it is uncertain how well ExCom will incorporate all UAS stakeholders so as to influence the technical and regulatory framework going forward. The high level of bureaucracy and organizational stakeholders required for developing a UAS regulatory framework makes it likely that this process will be long and arduous. Because of this, it is doubtful that the Coast Guard (or any other organization) will be able to take full advantage of the capabilities of UAS platforms within the national airspace.

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[19] U.S. Government Accountability Office, *UAS Federal Actions Needed*, 3-4.

[20] Ibid., 18.

[21] PL 110-417, Section 1036, Duncan Hunter National Defense Authorization Act for Fiscal Year 2009.

More Safety Challenges- Technology

Adding to the complexity of the UAS strategic environment are more technological challenges including obtaining a dedicated command and control communication spectrum link, reliability and performance issues, and standardized safety regulations. Unlike manned aviation today which currently uses protected radio frequency spectrum, UAS platforms operate with unprotected radio spectrum and are subject to interference, both intentional and unintentional. Without a pilot on board to override possible unintended deviations in flight path, UAS command and control cannot be guaranteed, which can adversely affect the safe operation of the UAS and NAS.[22]

Though UAS capabilities and technologies have advanced remarkably, their safety record still warrants a careful and deliberate review. CBP's UAS accident rate from 2006-2010 is seven times higher than the general aviation accident rate and 353 times higher than the commercial aviation rate.[23] Additionally, CBP has suffered from numerous UAS deviations, where the UAS has done something unplanned, such as violating an airspace regulation or going "lost link" and flying uncommanded.[24]

The crux of improving the safety of UAS systems may actually depend on improving the safety of the National Airspace System first. The next generation of

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[22] U.S. Government Accountability Office, *UAS Federal Actions Needed*, 18.

[23] John Allen and Nancy Kalinowski, *The Role of UAS*, 21.

[24] There are growing numbers of UAS incidents being reported. Recently, Navy operators conducting a Fire Scout UAS test flight from Patuxent River, Maryland went 'lost link' after losing their command, control, and communications link. The Fire Scout flew north for 23 miles and entered the restricted airspace over Washington D.C. before operators were able to regain control of the drone. In another instance, the U.S. Air Force lost link with a MQ-9 Reaper UAS in Afghanistan and had to shoot it down to prevent it from violating another country's airspace. See Elisabeth Bumiller, Navy Drone Violates Washington Airspace, *New York Times*, Aug 25, 2010, http://www.nytimes.com/2010/08/26/us/26drone.html (accessed Apr 1, 2011).; U.S. Air Force, "Reaper Crashes in Afghanistan," *Air Force News*, Sep 14, 2009, www.af.mil/news/story.asp?id=123167644 (accessed Jan 7, 2011).

aviation transportation and navigation, known as NextGen may have a significant role in determining how UAS platforms will be integrated into the NAS. NextGen is the evolution from a ground based navigation system to a more precise and safer satellite system. It involves "a complex mix of satellite navigation, digital networked communications, integrated weather systems, and layered adaptive security."[25] However, as with current and past safety systems, the coordination and development challenges for NextGen are immense. Efforts to regulate and integrate UAS platforms into the NAS may depend upon or intersect with efforts to develop NextGen. FAA Administrator Randy Babbitt explained that NextGen "will not only help us get to sense-and-avoid, but find interim solutions until we do."[26] While the NextGen system is being rolled out in phases, completion is not scheduled until 2025.[27] Ultimately NextGen will make the skies safer for all users; however delays in NextGen could potentially delay the integration of UAS with the NAS.

Joint interagency efforts such as ExCom, Special Committee 203, and others are necessary for unfettered UAS access to the NAS, but the challenges are many and it will likely be years before enough is known about the safe operation of UAS platforms. This will require continued development of safer technologies, such as advances in smaller and lighter sensors which enable see-and-avoid capability, and a robust set of regulations which ensure safety but do not restrict the intended capabilities of UAS platforms. Due to UAS safety concerns, the FAA has made it clear that they will not compromise the safety

[25] U.S. Government Accountability Office, *UAS Federal Actions Needed*, 41.

[26] Randy Babbitt, "Safety Must Come First," Speech to the Aerospace Industries Association, FAA.gov, Nov 18, 2009, http://www.faa.gov/news/speeches/news_story.cfm?newsId=10964 (accessed Jan 11, 2011).

[27] U.S. Government Accountability Office, *UAS Federal Actions Needed*, 40.

of the National Airspace System. Because of such operating restrictions, the Coast Guard has no assurances that they will be able to operate UAS platforms to meet service needs within the next decade.

Technology: Evolutionary vs. Revolutionary

In analyzing the UAS strategic environment, it is fundamental to understand that UAS platforms are not a technological panacea. UAS platforms are characteristically thought of as a cost efficient solution for enhancing operational capability due to their advanced technologies. These technologies are often described as revolutionary, creating the panacea affect. However, revolutionary technologies often require a maturation process; making use of these new technologies is more of an evolutionary process.

While technology has enabled UAS platforms with remarkable surveillance capabilities, leveraging technology without being counterproductive and eroding the organic capabilities of the UAS is a difficult challenge. Retired Lt. Gen. David A. Deptula, former Air Force Deputy Chief of Staff for intelligence, surveillance and reconnaissance (ISR) remarked that the biggest ISR challenge today is not getting enough information, but rather getting too much; "How do we find the relevant nuggets? We're searching for a needle in a needle-stack."[28]

The ability to create actionable intelligence from streams of data and surveillance imagery depends on having an adequate number of fully manned processing, exploitation, and dissemination (PED) cells. In PED cells, analysts are able to conduct real-time interpretive analysis of data and disseminate that intelligence to national users.

[28] Chuck Poane. "Air Force Official Discusses 21st century ISR Challenges," U.S. Air Force, http://www.af.mil/news/story.asp?id=123153736 (accessed Jan 11, 2010).

However, PED cell capabilities are usually limited by the number of trained analysts who interpret the data. It takes 19 highly trained analysts to run a PED cell for one predator.[29] Alluding to the inefficiencies of labor intensive PED cells, General James Cartwright, Vice Chairman of the Joint Chiefs of Staff explained that "an analyst sits there…for hours on end, trying to find the single target or see something move. It's just a waste of manpower."[30] Michael Kostelnik, Assistant Commissioner of the Customs and Border Protection (CBP) Office of Air and Marine, noted in testimony to Congress that the CBP's PED cells are not fully staffed and lack needed capabilities.[31]

As agencies evolve to leverage the revolutionary capabilities of UAS platforms, the evolutionary process of developing supporting technologies is causing considerable challenges. These technological challenges are just expensive examples of the challenges waiting for the Coast Guard to encounter. However, obtaining the necessary funding to keep up with the rapid evolutionary pace of technology is a major strategic challenge. Crafting a strategy that takes this into account is paramount. A UAS strategy must pursue resources (means) and methods (ways) which foster an evolutionary and maturing process to effectively implement the strategic objectives (ends).

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[29] Scott Hamilton, "Here's a Thought: Pentagon Wants 'Thinking' Drones," *National Defense Magazine*, Feb, 2011, http://www.nationaldefensemagazine.org/archive/2011/February/Pages/Here%E2%80%99saThoughtThePentagonWants%E2%80%98Thinking%E2%80%99Drones.aspx (accessed 2 Apr, 2011).

[30] New UAS sensor technologies under development are expected to exponentially drive the demand for more analysts. An example of this is the Air Force's newest wide-area airborne surveillance system (WAAS) called "Gorgon Stare." This system is outfitted with nine cameras on a Predator B UAS and will have the ability to transmit up to 65 different images to different users, which would potentially require up to 2000 analysts to process the data and footage from one single UAS; See Ellen Nakashima and Craig Whitlock, "With Air Force's Gorgon Drone 'we can see everything'," *The Washington Post*, Jan 2, 2011, http://www.washingtonpost.com/wp-dyn/content/article/2011/01/01/AR2011010102690.html (accessed 2 Apr, 2011).

[31] Michael Kostelnik, *The Role of UAS on Border Security*, Testimony to House Homeland Security Subcommittee on Border, Maritime, and Global Counterterrorism, U.S. Government Printing Office online, Jul 15, 2010, 39-40, http://www.gpo.gov/fdsys/pkg/CHRG-111hhrg64701/pdf/CHRG-111hhrg64701.pdf (accessed Jun, 7, 2011).

Fiscal Reality: Budget Cuts Swamping the Coast Guard

Fiscal challenges continue to dominate not only the UAS program but the Coast Guard as a whole. This of course is no surprise, as the United States is immersed in a fiscally-challenged environment where difficult decisions must be made to balance growing deficit levels with reduced spending and budget cuts.[32]

The Coast Guard's Fiscal Year 2011 Budget Request was 3 percent lower than 2010. This is partially attributable to a 10 percent decrease in requested funds for acquisition, construction and improvement (AC&I) and a 19 percent reduction in research, development, test, and evaluation (RDT&E), both of which are the pools of funding which drive the UAS program.[33]

The decrease in requested AC&I funding resulted from strategic acquisition decisions of Deepwater assets based on prioritization. Specifically, reduced funding was a tradeoff between current operational capacity and investment in future Coast Guard Deepwater assets. The reductions included eliminating five major cutters,[34] nine aircraft and five anti-terrorism Maritime Security and Safety Teams (MSST). These savings would pave the way for continued Deepwater program investments, including investment in a fifth National Security Cutter. Justifying this strategic priority, Admiral Allen stated

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[32] The United States' $14 trillion debt is currently 66 percent of GDP and expected to rise to 85 percent by 2015. The article noted that these dismal numbers "foretell a looming threat to the U.S.'s AAA credit rating" and that recent market indications suggest a downgrade is likely. See Deborah Blumberg, "Is Steep Yield-Curve Signaling Pain to Come?," *Wall Street Journal*, Jan 24, 2011, http://online.wsj.com/article/SB10001424052748704115404576096203894073570.html (accessed 2 Apr, 2011).

[33] U.S. Government Accountability Office, *Coast Guard: Observations on the Requested Fiscal Year 2011 Budget, Past Performance and Current Challenges*, Report to Congressional Committees, U.S. GAO (Washington, DC, Feb 25, 2010), 3.

[34] This proposal included eliminating 4 out of 12 High Endurance Cutters, and 1 Medium endurance Cutter.

that if the Coast Guard "does not make this commitment to our future, the Coast Guard's aging fleet will continue to deteriorate and rob us of our ability to protect, defend, and save well into the 21st century."[35] This is the long term risk to the service and the nation. In the short term, the Coast Guard and DHS are prepared to accept this risk that is inherent in the strategic imbalance between the performance demands on the Coast Guard, and the means and resources available to effectively carry out these demands.

Deepwater Costs Continue to Grow

The fiscal situation for the Deepwater program is similarly bleak. Costs have continued to climb as a result of delays, restructuring, and updating cost baselines. In 1998, the Coast Guard estimated the Deepwater program to cost $9.8 billion over a 20 year period.[36] Since then, acquisition costs have soared to $28 billion, a 285 percent increase. Additionally, this figure reflects newer cost baselines for only 60 percent of Deepwater assets. This immense cost growth is beginning to consume a larger share of the Coast Guards budget. A recent GAO report on the budget challenges of Deepwater showed that the program represents over 11 percent of the Coast Guard's proposed 2011 budget and "continuing into future budgets, Deepwater affordability is likely to continue to be a major challenge for the Coast Guard given other demands on the agency."[37] As cost baselines for assets are updated, the cost figure for Deepwater appears to be a

[35] Allen, Thad, "All Hands Messages: FY 11 Budget," U.S. Coast Guard, Feb 2, 2010, http://www.uscg.mil/history/allen/messages/message47.pdf (accessed Jan 14, 2011).

[36] U.S. Government Accountability Office, *Coast Guard: Observations on the Fiscal Year 2009 Budget, Recent Performance, and Related Challenges*, Report to Congressional Committees, U.S. GAO (Washington, DC, Mar 6, 2008), 24.

[37] U.S. Government Accountability Office, *Coast Guard: 2011 Budget*, 12-13.

moving target that will continue to rise, possibly hindering the funding of the UAS program.

UAS Funding Uncertain, but Congressional Support Growing

Funding for the UAS program continues to be a matter of speculation. In the past four years the Coast Guard has only requested $3 million total for the program. Approval of the Coast Guard's UAS Strategy in 2009 was expected to lead to UAS acquisition approval in 2012; however, this was based on a 2010-2012 funding stream.[38] For 2010, the Coast Guard did not request UAS funding despite the fact that there seems to be growing Congressional support and willingness to fund the Coast Guard's UAS efforts. The 2010 Senate Appropriations Committee recommended $10M for Research & Development (R&D) for UAS priority research. The Senate Committee also reported their strong support of "CBP's efforts to expand UAS operations into the maritime drug source and transit zones" and included a general provision directing the Secretary of DHS to consult with the Secretaries of Defense and Transportation to continue the development of a concept of operations for UAS platforms in U.S. airspace.[39]

The 2010 House of Representatives Appropriations Committee voiced their concerns over the growing maritime patrol hour and surveillance gap and also questioned the "absence of UAS funding requests given the unrealized potential of such assets for

[38] House Committee on Transportation and Infrastructure, *A Review of Coast Guard Acquisition Programs and Policies*, Summary of Subject Matter for the Subcommittee on Coast Guard and Maritime Transportation, 111th Congress, Mar 9, 2010, 15.

[39] Senate Appropriation Committee Report on bill S. 1298, 2010 DHS Appropriations, 111th Congress, Jun 18, 2009, S. Rept. 3, 39.

enhanced maritime surveillance."[40] Furthermore, the House Committee was concerned that the Coast Guard's NSC is "commencing operations without a viable UAS solution and therefore will not provide its projected surveillance capabilities."[41] Ultimately, the 2010 DHS Appropriations Act included $5M for UAS R&D; however, no funding was approved for UAS procurement.[42]

The Coast Guard Budget request for 2011 once again did not include funding for UAS R&D or procurement. Pending further funding, completion of the UAS acquisition has been postponed indefinitely.[43] In the FY2011 Congressional Justification, DHS stated that the Coast Guard's R&D Program plans a land-based UAS advanced concept technology demonstration (ACTD) in FY 2012 and that the program will develop an actionable UAS procurement plan. DHS stated similar goals for the cutter-based UAS, but did not give any timelines.[44] Pre-acquisition efforts are to continue by using prior year funding, although additional R&D funding might be requested in 2012 or 2013. The Senate Committee on the 2011 DHS Appropriations Bill tended to disagree with this slower approach, and recommended $8 million in R&D funds for necessary shipbuilding integration equipment and $2 million to accelerate pre-acquisition activities for the

[40] House Appropriation Committee Report on H.R 2892/P.L. 111-83 2010 DHS Appropriations Act. 111th Congress, Jun 16, 2009. H. Rept. 157, 82.

[41] House Appropriation Committee Report on 2010 DHS Appropriations Act. 111th Congress. H. Rept. 157, 86.

[42] Department of Homeland Security Appropriations Act of 2010. Public Law 111-83. (Oct 28, 2009).

[43] House Committee on Transportation and Infrastructure, *Coast Guard Acquisition Programs,* 15.

[44] U.S. Department of Homeland Security, *United States Coast Guard Fiscal Year 2011 Congressional Justification*, http://www.uscg.mil/history/allen/docs/USCGFY2011CongressionalJustification.pdf (accessed 2 Apr, 2011), 332, 335.

cutter-based UAS.[45] The House Committee and Joint committee recommendations on the 2011 DHS Appropriations Bill are still outstanding.

As the Coast Guard attempts to navigate the challenging waters of a fiscally austere environment, funding will likely be the most important strategic factor that drives future Coast Guard UAS plans and strategies. Other challenges such as airspace integration, safety concerns, technology development, and Deepwater program competition weigh heavily on the future direction of the UAS program. These technological, bureaucratic and fiscal challenges serve as key strategic factors which continue to drive and influence the strategic environment and Coast Guard's UAS strategy. According to strategist and Army War College professor Harry Yarger, "strategy is always subservient to the strategic environment."[46] This means that the formulation of strategy is derived from the complex interactions of an environment that is constantly in motion. Strategy must take this complex environment into account; however, pursuing strategic objectives can also play a role in influencing key strategic factors and shaping the ultimate environment. The Coast Guard must craft a realistic and forward moving strategy which takes this treacherous environment into account, applies an acceptable level of risk, while seeking an appropriate level of resources.

Appraising Strategy and Risk

Understanding the complex strategic environment serves as the foundation for appraising the Coast Guard's existing UAS Strategy and qualitatively assessing risk using

[45] U.S. Congress. Senate. *Department of Homeland Security Appropriations Bill, 2011*. 111th Congress, 2nd sess., Jul 19, 2010. S. Rep. 222, 84, 88.

[46] Harry Yarger, *Strategy and National Security*.

the Failure Mode Effects Analysis (FMEA). When appraising strategy, it is important to understand that strategy is a human endeavor which attempts to make sense of a complex and often chaotic environment. A well- thought strategy can help the understanding of complex non-linear relationships by considering a fundamentally linear framework of thinking.

The current Coast Guard UAS Strategy attempts to influence the technological, bureaucratic, and fiscal strategic factors where it can, and mitigate the strategic risk where it cannot. However, as it broadly seeks ways to connect a desired future end state with current or required means and resources, the current strategy does not adequately account for Coast Guard actions which tend to contradict the original assumptions made about the strategic interest and objectives (ends) of the UAS program. Furthermore, the current UAS strategy seems to have been created without regard for resource constraints (means). A strategy that does not have the relevant resources to drive the strategy is no strategy at all and is nothing but a contradiction.

The original impetus of the UAS program emphasized that UAS surveillance capabilities were designed to directly enhance and complement the operational performance criteria of the National Security Cutter (NSC) and Offshore Patrol Cutter (OPC). The Coast Guard used the more capable NSCs supported with UAS platforms to justify the future fleet mix, replacing twelve High Endurance Cutters with only eight NSCs. Without the supporting capability of UAS platforms, the adequacy of the true operational capability of the NSC remains in question, while the potential exists for growing maritime surveillance gaps. However, this assumes that the NSCs performance criteria and ensuing fleet mix is valid. Until the Coast Guard validates or modifies this

assumption through their fleet mix analysis, the critical system-of-systems link of UAS capabilities to NSC and OPC capabilities cannot be justified as a strategic imperative.

Similarly, while UAS platforms have the potential to close the Coast Guard's aircraft MPH gap, the technological and regulatory hurdles facing the program cast doubt that, in the coming decade, UAS platforms will be able to fully operate in the National Airspace System without operational restrictions. Until these requirements are fully defined, the long-term mission capabilities of UAS platforms will remain uncertain. These unknown requirements could severely restrict the duration and usefulness of maritime patrol and surveillance hours from UAS platforms, as a means to concurrently close the MPH gap.

In addition, the Coast Guard has consistently shown that it is not willing to adequately resource the UAS program. In the past four years alone, the Coast Guard has only requested $3 million for the program. Over the next decade, fiscally austere budgets will dominate the national strategic landscape. For the Coast Guard, this likely represents decreasing funding. For the UAS program, competition with other large and more prominent Deepwater acquisition programs will likely result in inadequate funding over the next decade.

Without assurances that the Coast Guard can develop a UAS fleet which will be able to operate without operational restrictions, the Coast Guard strategy seems deliberate in having a slowed approach to develop this nascent program. Scaling back the program and leveraging partnerships have mitigated overall programmatic risk and no doubt saved millions in development funding. In fact, this very limited approach is indicative of the extraordinary amount of risk that is inherent in the UAS program. As the Coast Guard

cannot afford the failure of another major acquisition, the Coast Guard seems almost prescient in their slowed ‘wait-and-see’ approach.

However, risk is inherent throughout the strategy formulation process. Every action or decision, including deciding in favor of the status quo, carries with it a degree of risk. An imbalance between ends, ways, and means exposes risk in a strategy. Practitioners of strategy must have knowledge in framing complex interwoven and dynamic variables and adapting to the affect of subtle changes within the strategic framework; models help to frame these variables in a linear picture that is easier to understand.

The Concept Failure Mode and Effects Analysis (FMEA) is an inductive technique used to analyze concepts to identify potential failures modes in a process or system. FMEA is historically an engineering technique and has been widely used by NASA since the 1960s. Using this methodology in a qualitative context will help define the risks and mitigations for the Coast Guard’s UAS strategy. When risk is identified, risk reduction is addressed by employing mitigation efforts, modifying the strategy, or by accepting the current level of risk. While the Coast Guard has largely mitigated a major amount of developmental and acquisition risk, the FMEA methodology (See Table 1) has shown that there is considerable risk in the slowed status quo, wait-and-see approach.

Conceptual Failure Mode & Effects Analysis of Coast Guard UAS Strategy						
Function	**Potential Failure Mode**	**Cause**	**Effect**	**Risk**	**Mitigation**	**Residual Risk**
Airspace	UASs are not integrated into National airspace System in next 5- 10 yrs.	FAA safety concerns	Restrictions on operations reduce UASs effectiveness and could delay UAS program several yrs.	High	Continue UAS collaborative partnerships and R&D. Improve strategic comms to push airspace integration efforts. Build operational experience using low cost, smaller UAS platforms.	Medium
Funding	Insufficient Acqusition/ lifetime Funding	Fiscally Constrained Economic Environment / Competing higher priority programs	Delayed or Failed UAS program	High	Continue UAS collaborative partnerships / combine CBP & USCG land-based maritime programs. Build operational experience using low cost, smaller UAS platforms.	Medium
Acqusition Timeframe	Delayed UAS Acqusition	High level of residual risk and/or lack of funding	Reduced NSC Maritime Surveilance & MDA	Medium	Use Fleet Mix Analysis to verify NSC performance measures. Improve other MDA initiatives such as AIS and C4ISR and build operational experience using low cost, smaller UAS platforms.	Low
			Sustained or increasing Maritime Patrol Hour Gap	Medium	Revalidate original MPH Gap numbers and consider accounting for interagency patrol and MDA efforts. Improve other MDA initiatives such as AIS and C4ISR and build operational experience using low cost, smaller UAS platforms.	Low

Table 1. Conceptual Failure Mode & Effects Analysis (FMEA)

FMEA mitigation efforts include:

- Continue UAS collaborative partnerships and R&D.
- Build operational experience using smaller, low cost UAS platforms.
- Merge CBP & USCG land-based maritime programs.
- Verify NSC performance measures using Fleet Mix Analysis.
- Improve other MDA initiatives such as Automated Identification System (AIS) and C4ISR.
- Verify original MPH Gap numbers and consider accounting for interagency patrol and MDA efforts.

This wait-and-see approach presents few alternatives for moving the program ahead. The Coast Guard paradigm is one that is haunted by missteps and failures. This view is creating an unnecessary preponderance for being risk-adverse, not seeking relevant

funding to resource the strategy, and moving too slowly with the UAS program. While risk mitigation is absolutely necessary for overcoming the numerous challenges already mentioned, some risk must be acceptable for the Coast Guard to not only acquire UAS platforms but to also be operationally proficient in using them. Being overwhelmingly risk-adverse in this program has nudged the Coast Guard towards complete dependency on the Navy and CBP.

Strategy is not fixed; it must be adaptable and responsive to the influencers of the strategic environment. Using the strategy formulation process and enacting the risk mitigation recommendations presented by the FMEA process allow the Coast Guard to seek a better balance of risk acceptance and avoidance. This sets the stage for a modified UAS strategy which takes into account key strategic factors.

CHAPTER 4: RECOMMENDATIONS

A Modified UAS Strategy

Currently, key strategic factors introduce numerous elements of risk which vastly threaten the successful implementation of a UAS Operational Strategy. While not predictive of the future, strategy can help anticipate what the future might look like and influence and shape the strategic environment and the desired outcomes. A UAS strategy must effectively describe this future end state and provide a clear link between resources (means), applying resources (ways), and the objectives (ends). Recommendations incorporate the ends, ways, means paradigm and are based on the strategy formulation process and the ensuing conceptual FMEA risk based assessment.

Combine Customs and Border Patrol and Coast Guard Land-Based UAS Programs

The Coast Guard and CBP are pursuing UAS maritime strategies which are complementary in nature. In fact, it is hard to find differences in the two service's maritime UAS strategies. This strategic overlap becomes more apparent as the two DHS service components continue to work closely together. Combining the two UAS programs would create synergy and better leverage a whole-of-government approach. Service parochialism would likely dictate the need for organic assets and capabilities; however this ignores DHS's responsibility to leverage scarce resources across two agencies with similar mission sets. In the near future, the government will be required to balance woefully overleveraged debts with painful spending cuts. From a department level, DHS cannot ignore the potential savings in merging similar programs while at the same time improving operational synergy.

Develop a Department of Homeland Security UAS Strategic Roadmap

A DHS UAS strategic roadmap should address UAS program synergy with intra-agency missions and goals to leverage shared strategies and joint capabilities across similar mission sets. Without a clearly defined UAS strategic roadmap which links UAS capabilities (resources) and service initiatives (means) to defined missions (goals) of DHS and national level strategies and policies, the risks of changing fiscal and political environments will continue to threaten the viability of a timely and successful Coast Guard UAS program.

Pursue Small Tactical Cutter-Based UAS Platforms as Part of the Coast Guard UAS Strategy

Integrator Maritime STUAS
Photo by Insitu Corp.

Ongoing understanding of current UAS tactics, techniques and procedures will help inform the future of the Coast Guard UAS program. The Coast Guard should modify current strategy to develop and acquire small tactical UAS platforms (STUAS), such as the Scan Eagle, Night Eagle, or Integrator. This approach is typically termed the 70 percent solution; though delivering less capability than required, it does so at exponentially less risk than a larger, more complex 100 percent UAS solution. The Scan Eagle and Integrator have amassed over 470,000 hrs operating with DOD in Iraq, Afghanistan, the Persian Gulf and the Horn of Africa, and have logged over 2280

maritime sorties with the Navy.[1] Maritime STUASs are typically rail launched from ships and recovered via net or hook-and-recover methods.

Advances in sensor technologies are already creating lighter and more capable payloads, allowing for smaller and more capable maritime UASs. In fact, the scaling of new sensor technologies may soon make STUAS the 110 percent solution. An example is Boeing/Insitu's recent development of the world's smallest synthetic aperture radar (SAR) payload for the Scan Eagle and Integrator. While previous SAR payloads weighed over 30lbs, this two pound sensor, called NanoSAR, allows high-level imagery which can penetrate adverse weather conditions.[2] Another advantage is that STUAS are relatively cheaper and usually do not qualify as a major systems acquisition, which allows for a more streamlined acquisition process. Commonality with DOD will also present opportunities to streamline the acquisition process while lowering overall cost.

Integrator STUAS Recovery
Photo by Insitu Corp.

Additionally, the relatively low cost of STUASs substantially reduces the long term risk posed by technology obsolescence from that of a larger and more expensive

1 Insitu Corporation, located on main web page under "Insitu in the Field," http://www.insitu.com (accessed Jun 7, 2011).

2 Insitu Corporation, "Boeing Flight-Tests 2-Pound Imaging Radar Aboard Scan Eagle Unmanned Aircraft," Mar 18, 2008, http://www.insitu.com/index.cfm?cid=3825 (accessed Jan 12, 2010).

UAS. Emphasizing this, Marine Corps Brigadier General Glenn Walters, deputy director for resources and acquisitions for the Joint Staff, J8, warned against using old business practices when it came to buying UAS platforms, "Models shouldn't be in the inventory for 30 years as some other equipment. If a production line is started, it shouldn't last more than five years. Then the aircraft should be redesigned."[3]

In August, 2010, the U.S. Navy and Marine Corps awarded Boeing/Insitu a five year contract to buy 56 STUASs to replace the Navy's leased Scan Eagles with the more capable Integrator.[4] These UAS platforms have been operationally proven in the maritime domain to leverage their enhanced capabilities and gain critical UAS operational experience. The benefits of STUASs include: operationally proven in the maritime environment, technologically and production mature, commonality with DOD programs, improved ISR capabilities, lower cost and faster acquisition, and lower overall long term risk.

These recommendations provide a logical path towards improving the Coast Guard UAS strategy. Strategy cannot be fixed; it must be able to influence and adapt to the strategic environment. From a strategic ends, ways, and means paradigm, these recommendations address changes to the means and the ways to ultimately achieve the ends by addressing fiscal, bureaucratic, and technological strategic drivers.

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[3] Stew Magnuson, "Future Remotely Piloted Aircraft Will Do More Than Surveillance," *National Defense*, Mar 2010, http://www.nationaldefensemagazine.org/archive/2010/March/Pages/RemotelyPilotedAircraft.aspx (accessed Apr 12, 2011).

[4] John Reed, "Insitu Eyes Midsized UAV Niche," *Defense News*, Aug 16, 2010, http://www.insitu.com/index.cfm?navid=299&cid=5072 (accessed Dec 12, 2010).

CHAPTER 5: CONCLUSION

The efforts to develop UAS platforms in the Coast Guard are on a historically parallel path of the early Coast Guard helicopters. The pioneering spirit of LCDR Frank Erickson should stand as an example of the determination, vision, and boldness which ushered in a new age in aviation history. While early development of the helicopter was fraught with technological, bureaucratic, and fiscal uncertainties, and a decade-long maturation process, determined leadership from a visionary like Erickson was essential to making helicopters the back-bone of Coast Guard aviation. The Coast Guard must be mindful of the past, yet forge ahead into the future.

There is no doubt that unmanned aviation will be the next generation in flight. Advances in regulations, technologies, and procedures will usher in this new generation of flight for adaptation into the National Airspace System, not only in the U.S. but worldwide. To bridge the gap between now and then, the Coast Guard must modify their current UAS strategy to combine CBP and Coast Guard land-based UAS programs, initiate the development of a DHS UAS strategic roadmap, and pursue small tactical UAS (STUAS) platforms. This modified strategy is based on the strategic paradigm of ends, ways, and means and accounts for the technological, bureaucratic, and fiscal strategic factors which shape the UAS strategic environment.

A combined CBP and Coast Guard land-based UAS program will integrate and synchronize common functions and mission areas. UAS integration will enhance DHS missions while reducing redundancy between the two programs, foster greater bureaucratic support, and strategically allocate scarce fiscal resources.

In line with a combined CBP/Coast Guard land-based UAS program, a DHS UAS strategic roadmap will establish intra-agency goals to leverage shared strategies and joint capabilities across similar mission sets. This roadmap should clearly define and link UAS capabilities (resources), service initiatives (means), and defined missions (goals) of DHS and national-level strategies and policy. This strategic roadmap will solidify bureaucratic and fiscal support while reducing the risks of changing fiscal and political environments.

Lastly, the Coast Guard should leverage and pursue the enhanced capabilities of STUAS to gain critical UAS operational experience. The benefits of STUAS include adaptability to the maritime environment, technological maturity, and interoperability with DOD programs. As an Intelligence, Surveillance, and Reconnaissance (ISR) platform, it is capable of faster acquisition, lower long-term program risk, while costing less to employ and operate.

Unknowns and uncertainties, many of which are outside of the Coast Guard's control, obfuscate the picture of what the Coast Guard UAS program will look like in 2020 and beyond. This necessitates a well-crafted and adaptable UAS strategy that can anticipate what the future might look like and influence and shape the strategic environment and the desired outcomes. This proposed modified UAS strategy will help overcome strategic challenges, give the Coast Guard the capability to enhance America's security, and in doing so, help define the next era in Coast Guard aviation.

ACRONYMS

ACTD	**Advanced Concept Technology Demonstration**
AC&I	**Acquisition, Construction, and Improvement**
ADE	**Acquisition Decision Event**
AIS	**Automated Identification System**
BAMS	**Broad Area Maritime Surveillance (Navy)**
C4ISR	**Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance**
C4IT	**Command, Control, Communication & Computer Information Technology**
CBP	**Customs and Border Patrol**
CDP	**Capabilities Development Plan**
COA	**Certificate of Authorization (FAA)**
CONOPS	**Concept of Operations**
DHS	**Department of Homeland Security**
DOD	**Department of Defense**
DT/OT	**Developmental Test/Operational Test**
ExCom	**Executive Committee**
FAA	**Federal Aviation Administration**
FMA	**Fleet Mix Analysis**
FMEA	**Failure Mode and Effects Analysis**
FY	**Fiscal Year**
GAO	**Government Accountability Office**
HALE	**High Altitude Long Endurance**
ICAO	**International Civil Aviation Organization**
ISR	**Information, Surveillance, & Reconnaissance**
MDA	**Maritime Domain Awareness**
MNS	**Mission Needs Statement**
MOA	**Memorandum of Agreement**
MPH	**Maritime Patrol Hour**
MSST	**Maritime Security and Safety Team**
NAS	**National Airspace System**
NASA	**National Aeronautic and Space Administration**
NSC	**National Security Cutter**
OAM	**Office of Air and Marine (CBP)**
OE	**Operating Expenses**
OIG	**Office of Inspector General**
OPC	**Offshore Patrol Cutter**
PED	**Processing, Exploitation, and Dissemination**
PORD	**Preliminary Operational Requirements Document**
R&D	**Research and Development**
RDT&E	**Research, Development, Test, and Evaluation**
SAR	**Synthetic Aperture Radar**
STUAS	**Small Tactical UAS**
UAS	**Unmanned Aircraft System**
UAV	**Unmanned Aerial Vehicle**
USCG	**United States Coast Guard**
VUAV	**Vertical Takeoff and Landing UAV**

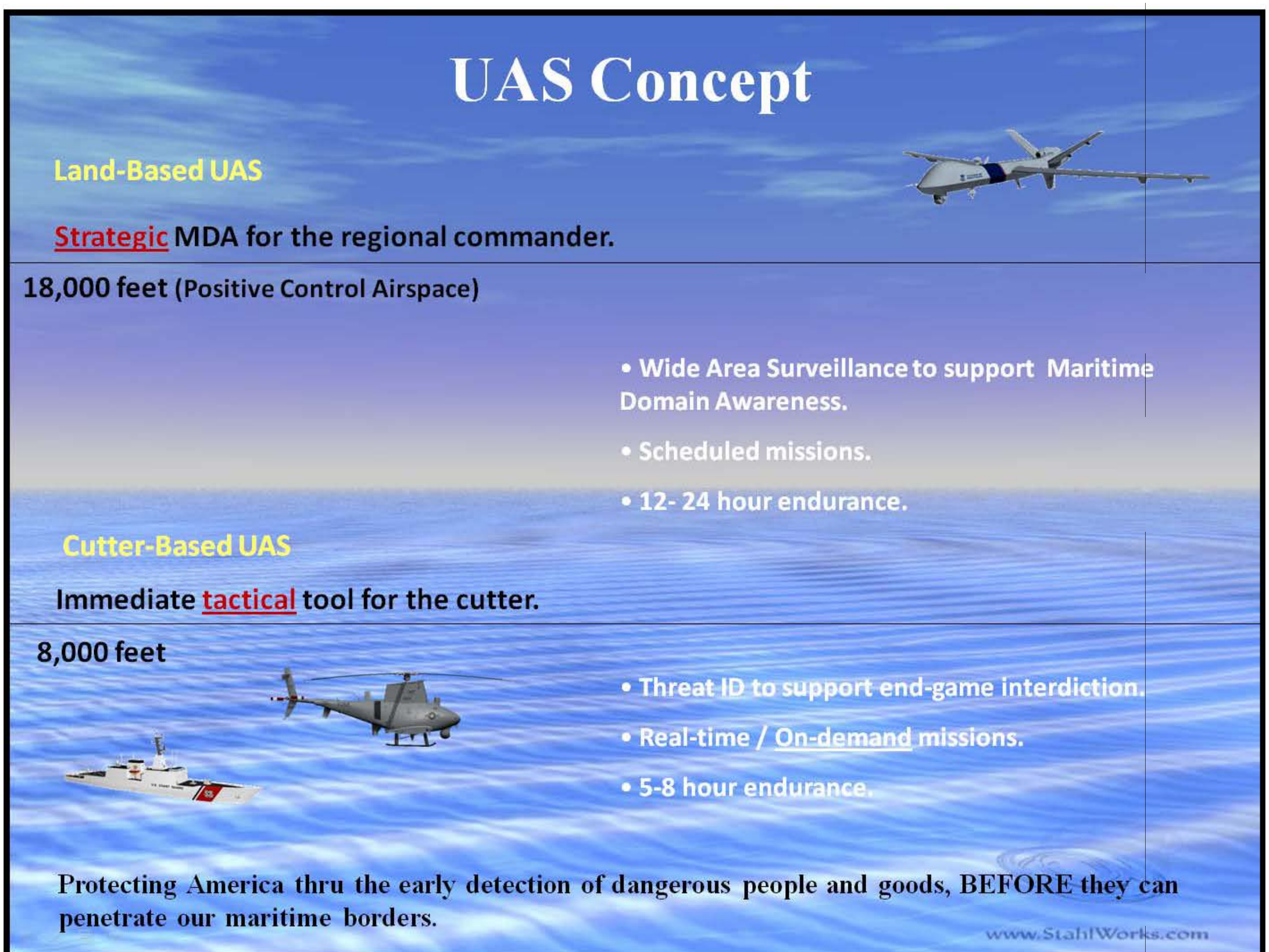


ILLUSTRATION A

UAS Strategic Concept

Coast Guard UAS Overview, Office of Aviation Forces

Current Capabilities - MQ-8B Fire Scout

Length Folded	22.87 ft
Rotor Diameter	27.50 ft
Height	9.42 ft
Gross Weight	3,150 lbs
Engine	RR 250-C20W
Speed	125+ Knots
Ceiling	20,000 ft
Flight Time (baseline payload)	8+ Hours
Flight Time (500 lb payload)	5+ Hours
Sensors	Telephonics 1700B Radar Brite Star II EO/IR AIS Transceiver

ILLUSTRATION B
MQ-8 Fire Scout Capabilities
Coast Guard UAS Program Overview, Office of Aviation Forces

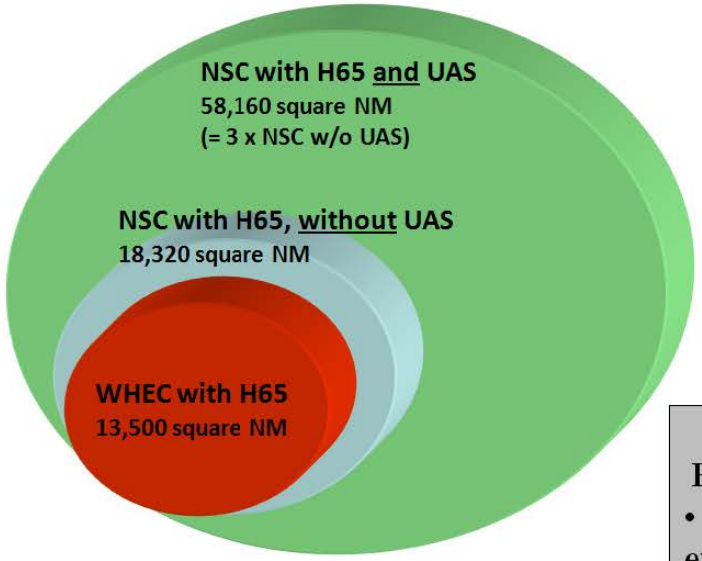
Current Capabilities – MQ-9 Guardian

Length Folded	**33 ft**
Wingspan	**67 ft**
Max Gross Weight	**10,500 lbs**
Engine	**Honeywell TPE 331-10T**
Speed	**240 Knots**
Ceiling	**Up to 50,000 ft**
Flight Time	**Up to 20 hrs**
Sensors	**Raytheon SeaVue Radar (w/NAVSEA upgrade), EO/IR, AIS, 2 X ARC-210**

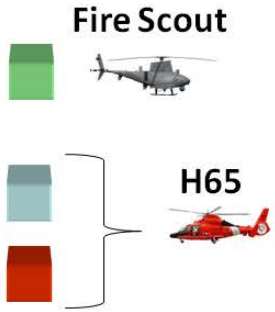
11

ILLUSTRATION C
MQ-9 Guardian Capabilities
Coast Guard UAS Program Overview, Office of Aviation Forces

Force Multiplier for NSC



CG Cutter on station for 24 hours
1 short-range helo /4 flight hours
2 UAS /10-16 flight hours



Cutter-Based UAS CONOPS

Provide 1-2 over-the-horizon sorties per day:

- 5-8 hr sorties each; greater persistence, fewer evolutions
- Feed tactical imagery, radar tracks and AIS data to cutter and OpCenters
- Provide aerial surveillance of boarding teams and suspect vessels
- Provide on-scene commander with detect/ID capability and improved ability to coordinate end-game assets
- Provide cutter with timely, on-scene air support

6

ILLUSTRATION D
UAS Force Multiplier for the National Security Cutter
Coast Guard UAS Overview, Office of Aviation Forces

APPENDIX A

Coast Guard UAS Strategy

CLEARANCE SHEET FOR VCG/CCG SIGNATURE

A-24136
ECT WF 809144
January 12, 2009

CG-09ES0	CG-7 YNI 12 JAN 09
CG-09ES	
CG-09EA	Recommend approve/expedite. Copy will go to VCG for her review after-the-fact.
CG-00EA	SS1-13 Rec. you concur w/CG-7 proposal to fund UAS strategy to S-2 – CG-7 has signed memo and just wants your concurrence.
VCG	
CCG	

Coast Guard Unmanned Aircraft System (UAS) Strategy

U.S. Department of Homeland Security
United States Coast Guard

Commandant
United States Coast Guard

2100 Second Street, S.W.
Washington, DC 20593
Staff Symbol: CG-9
Phone: (202) 475-3000

7044
JAN 14 2009

MEMORANDUM

From: W.E. Justice, RADM
CG-7

M. F. Tangora
CG-9

Reply to Attn of: CG-9
LCDR N. Carter

To: Paul F. Schneider, Deputy Secretary
Department of Homeland Security

Thru: 1) CCG
2) VCG
3) CG-01
4) DCO

Subj: COAST GUARD STRATEGY FOR UNMANNED AIRCRAFT SYSTEMS (UAS)

1. The Capabilities Directorate (CG-7) has requested acquisition of unmanned aircraft systems (UAS) to *"improve mission effectiveness and operational efficiency. UAS is one such technology, due to its unique capabilities and especially its capacity to provide persistent C4ISR, ... poised to become a cornerstone of Maritime Domain Awareness (MDA), and significantly close the Maritime Patrol Hour (MPH) gap. Funding the development of CG land-based UAS capability is critical to closing this gap and its impact on Wide Area Surveillance (WAS) and MDA. In addition, I would like to have the flexibility, DHS permitting, to apply funds to the Coast Guard cutter-based capability as well."*

2. The FY08 Coast Guard RDT&E Appropriation included funding and direction to *"determine the most effective unmanned aerial system to operate off the NSC..."* As part of this current research endeavor, the Coast Guard will demonstrate a cutter-based UAS off the USCGC BERTHOLF. In past research endeavors, the Coast Guard demonstrated land-based UAS capabilities in the maritime environments off of Alaska and Florida.

3. In response to these drivers, the Coast Guard Acquisition Directorate (CG-9) is pursuing a strategy leading to the acquisition of both land-based and cutter-based UAS capabilities to improve the situational awareness of the regional commander and the cutter commander respectively. The strategy precedes any future acquisition with adequate mission analysis, market research, alternatives analysis, testing, and evaluation. The pre-acquisition phases include "advance concept" technology demonstrations (ACTD) that show how UAS technologies developed by other agencies can be adapted for the Coast Guard's multiple missions and maritime environments. These ACTD's will use Coast Guard-owned capability where necessary and leverage the investments, developments, and infrastructures of other government agencies where possible. These ACTD's will be extensive demonstrations focused on building the knowledge and experience needed to reduce the risk of future acquisitions and inform the concepts of operation and support.

- During FY09 we are executing an RDT&E project to prepare for a land-based ACTD. We are also taking the early steps laid out in the Major Systems Acquisition Manual (MSAM).
- For FY10, we have requested RDT&E funding for a land-based UAS ACTD.
- For FY11, we plan to request RDT&E funding for a cutter-based UAS ACTD.

4. Our UAS strategy and context are detailed in the enclosed white paper and timeline. Since the goal of these projects is discovery, their reflexive nature may cause our strategy to change in the future to adapt to the improved knowledge and experience. The strategy is three-fold, acquiring cutter based and mid altitude UAVs and exploiting information available from high altitude platforms.

5. Request the Department concur with the Coast Guard's proposed strategy.

#

Encl: (1) Coast Guard UAS Strategy
(2) Plan of Action & Milestones (POA&M)

Copy: CG-1, CG-2, CG-4, CG-5, CG-6, CG-7, CG-8, CG-91, CG-92, CG-93, R&D Center

U. S. Coast Guard
Unmanned Aerial Systems Strategy
8 January 2009

UAS Strategy Statement: UASs have the potential to serve as effective multi-mission surveillance platforms in the maritime environment, augmenting both cutter-based rotary wing aircraft and land-based fixed wing aircraft. "Persistent Wide Area Surveillance" is a critical element in developing Maritime Domain Awareness and in delivering actionable data to mission commanders. The Coast Guard has documented significant capacity gaps in both the rotary wing and fixed wing domains, both of which are major providers of persistent wide area surveillance. The Coast Guard is conducting a detailed force mix analysis to optimize the use of manned and unmanned aerial surveillance platforms in both tactical and strategic roles.

The Acquisition Directorate UAS strategy:

Major Acquisition exists to develop and procure capabilities required to meet the sponsor's requirements. In August, 2008, the Coast Guard completed a VUAV Path Forward Study that determined that both land and cutter based UASs have the potential to provide cost-effective solutions to provide maritime surveillance. UASs offer significant operational potential through a least cost, best value and persistent solution to maritime surveillance. As such, CG-9 will: acquire mid-altitude long-range and low-altitude cutter based tactical UAS to meet mission requirements while emphasizing (1) commonality with existing DHS and DOD programs, (2) ensuring projects are technologically and production mature, (3) using studies leading to Advanced Concept Technology Demonstrations (ACTD) or Low-Rate Initial Production (LRIP) to mitigate production risk, and (4) where possible leverage off other organization's UAS development and non-recurring engineering costs.

Specific UAS strategic efforts being pursued:

- ***Tactical, Cutter-based UAS***: The cutter-based UAS will notionally provide surveillance similar to what is currently provided via embarked helicopters, effectively extending a cutter's immediate surveillance horizon. The USCG is conducting a $6.7M study, through FY08 RDT&E, to determine the most effective UAS to operate off the National Security Cutter (NSC). This study will determine the technological and airspace constraints, perform market research, conduct modeling & simulation and field testing of the most viable UAS candidates and report on the most effective UAS platform and payload for NSC mission support. The USCG researchers are paying particular attention to the Navy Fire Scout Program, which ranked highest in the recently completed, independently performed Integrated Deepwater System Alternatives Analysis. Of critical importance to the USCG is the success of on-going efforts by the Navy and the contractor to integrate maritime radar on the Fire Scout and the Navy's successful operational tests on a surface combatant. The USCG must have a method of detecting non-cooperative targets moving on the water's surface. An integrated maritime radar on the Fire Scout could accomplish this. Further, the cutter-based UAS must be able to perform the entire surveillance, detection, classification, and identification chain, particularly identification, which uses optics to acquire key identifying characteristics of a vessel of interest prior to prosecution by the cutter's boarding team or weapons systems. During subsequent boardings, the cutter-based UAS performs close-in

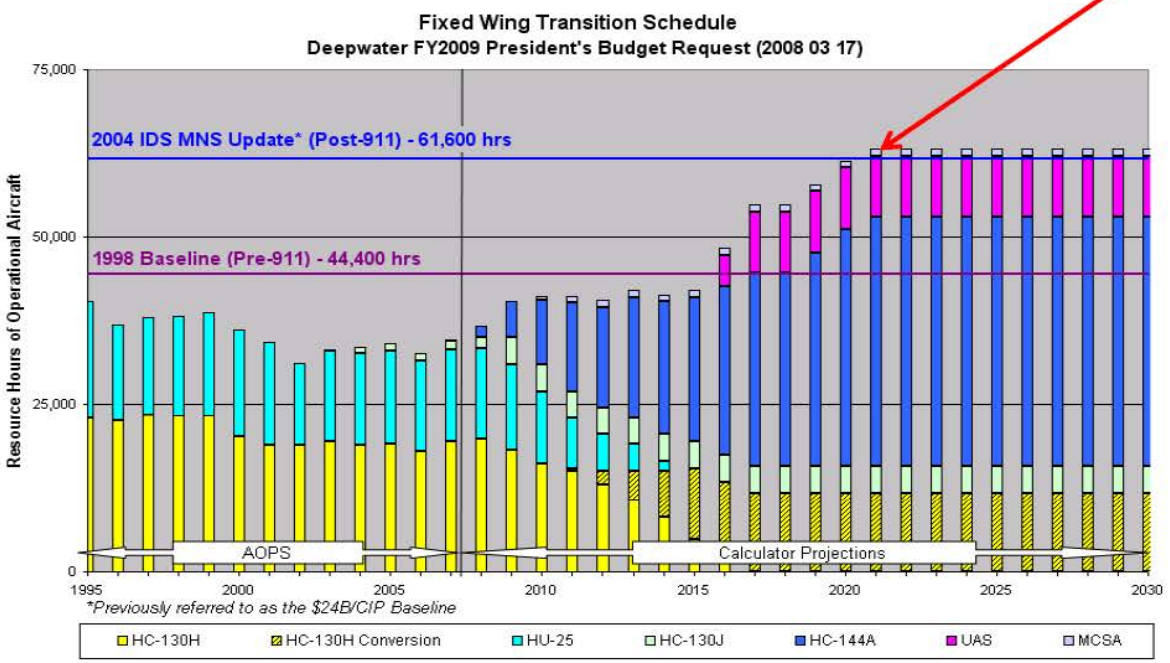
reconnaissance to enhance boarding-team safety and gather video evidence. The USCG intends to pursue outyear funding for an ACTD of the VUAS candidate ultimately recommended.

- ***Tactical, Land-based UAS***: The land-based UAS will notionally provide surveillance similar in nature to what is currently provided via various maritime patrol aircraft. The USCG is requesting $25M in FY10 for an ACTD of a land-based medium-altitude UAS. The ACTD concept is for the USCG to procure an UAS with a maritime radar and other needed avionics, and operate it extensively within maritime missions in various environments to develop a clear understanding of the required characteristics of a "marinized" land-based UAS. This information will provide a critical feedback loop to better inform DHS's requirements and CONOPS for maritime UAS acquisition and operation. The information will also enhance industry's development of marinized UAS alternatives and improve the government's evaluation of subsequent proposals. The USCG is paying particular attention to the Predator platform, the UAS being operated by CBP along the southwest border and supporting joint DoD operations in southwest Asia. Of critical importance to the USCG are: (1) industry's integration of anti-icing technology, (2) advances in maritime sensors and communications technology, (3) maturing airspace regulations, and (4) fully developing UAS CONOPS within the fleet. Knowledge of these issues was improved during the 2008 Gulf Coast Maritime Demonstration; however, additional resources must be applied to addressing Critical Operational Issues.

- ***Strategic, High-altitude (HALE) UAS***: HALE UAS platforms are viewed as strategic national assets with information of value to the operational commander. Of particular interest to the USCG is the Global Hawk UAS since it recently won the competition for the Navy's Broad Area Maritime Surveillance (BAMS) Program. However, even when fully deployed, the BAMS UAS is viewed as a complement to – and not as a replacement for – tactical and other land-based UASs. The BAMS UAS is unable to identify non-cooperative targets of interest due to its high altitude and frequent cloud cover between the UAS and the target. Although it is physically possible for the BAMS UAS to descend to altitudes from where its optical sensor can read a vessel's name, the airspace restrictions as well as the time and expense for such a diversion makes this highly impractical in CONOPs. A recently performed assessment by the Air Force Operational T&E Center (AFOTEC) indicated the Global Hawk images were transferred to the Joint Ops Command Center, and a more tactical asset was then vectored to intercept the target of interest. Regardless, the BAMS Program intends to publish the UAS surveillance data net-centrically to allow subscription by authorized users such as the USCG and CBP, thereby providing strategic intelligence and maritime domain awareness useful for cueing tactical assets. The USCG is an active participant in the DoD development of net-centric data-sharing for maritime domain awareness and will continue to monitor the progress of this program with an objective to harvest tactical information and integrate it into the overall Coast Guard common operating picture

Land-Based UAS Requirement

Land-Based UAS contribution 9,200 hrs beginning in 2021.



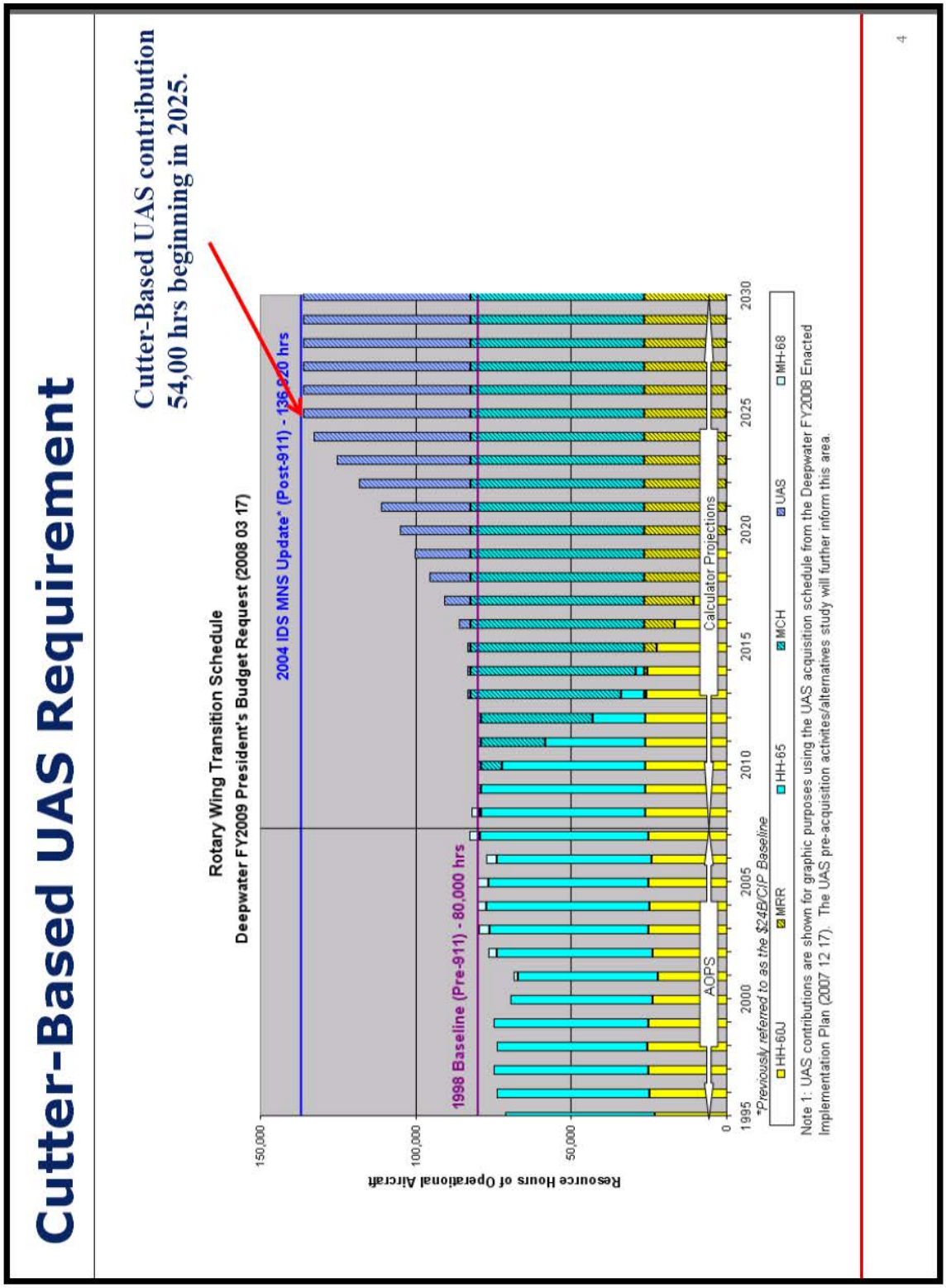
Note 1: Hours reflect contribution of the covert, multi-sensor, surveillance aircraft (MCSA) as part of the Deepwater System. The MCSA is not part of the Deepwater acquisition, but its potential contribution to maritime domain awareness is reflected in this graph.
Note 2: UAS contributions are shown for graphic purposes using the UAS acquisition schedule from the Deepwater FY2008 Enacted Implementation Plan (2007 12 17). The UAS pre-acquisition activites/alternatives study will further inform this area.

8

APPENDIX C

Maritime Patrol Hour Gap for Cutter-based Assests

Coast Guard UAS Program Overview, Office of Aviation Forces



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VITA

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LCDR Egan earned his commission in 2000 from the U.S. Coast Guard Academy. His first assignment was as a Deck Watch Officer aboard the Coast Guard Cutter SEDGE home ported in Homer, AK. Follow on tours included Naval Aviation Flight Training at NAS Pensacola and assignment to Coast Guard Air Station, Miami. LCDR Egan has participated in numerous rescues during Hurricane Katrina operations and in response to the explosion on the Deepwater Horizon oil rig.

LCDR Egan is a graduate of the U.S. Coast Guard Academy with a Bachelor's degree in Management. He has also has earned a Master's Degree in Business Administration from Liberty University.